October 1978

Smithsonian

Nelson Rockefeller's primitive art memorial to his son Michael (p. 42). Above, 'sea-bear' mask

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The Lunar Vase is on display now at Steuben Glass, 717 Fifth Avenue, New York, N.Y. 10022. (For the new 1978-1979 Steuben Catalogue, to be mailed early November, send $3.00.)

Steuben is part of Corning Glass Works, and has been since 1918.

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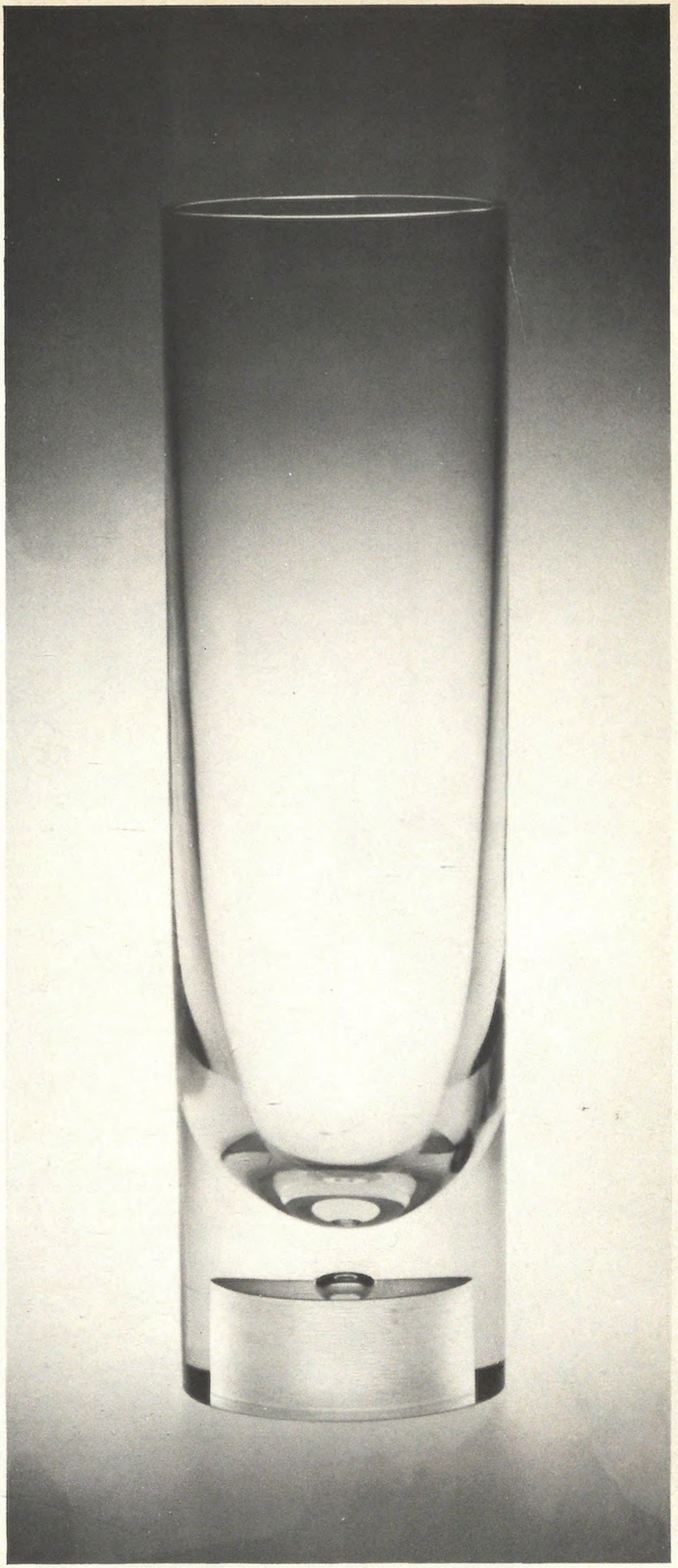

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October 1978

Smithsonian

Volume 9, Number 7

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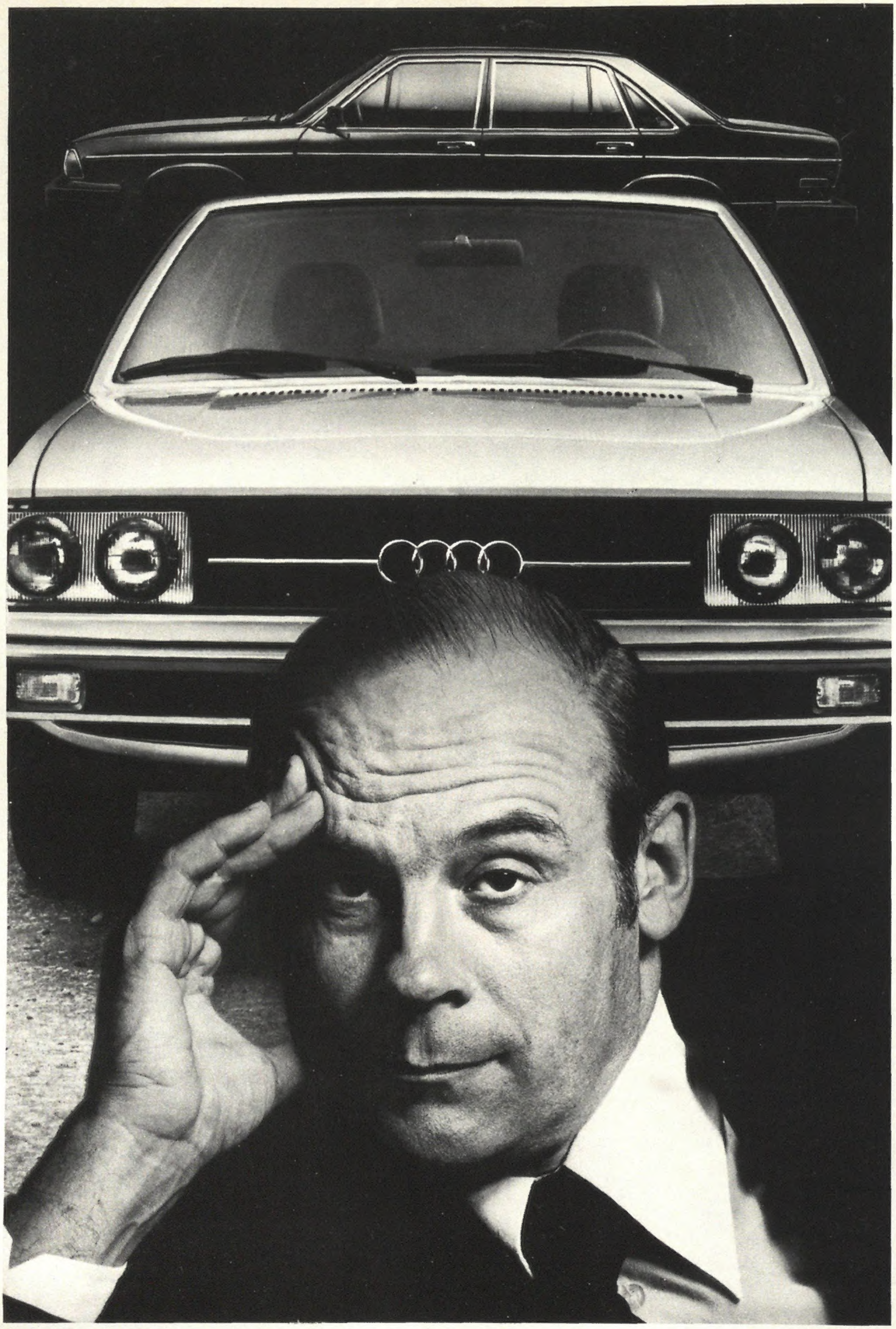

"WE SOLVE PROBLEMS. IF YOU THINK THE AUDI 5000 IS BEAUTIFUL, SO MUCH THE BETTER."

AN INTERVIEW WITH HERBERT BROCKHAUS, HEAD OF STRUCTURAL TESTING

Are you saying that beauty wasn't your prime concern?

Brockhaus: With us, styling and engineering go hand in hand. They are one and the same. When I look at the car, I can see all the parts underneath. Like x-ray vision, if you will. The styling is an essential part of the engineering and vice versa, which is as it should be. If the car is attractive, it is basically because of the elegant engineering solutions.

Isn't it a bit pompous to say you solve problems? Don't all car manufacturers?

Brockhaus: Some car manufacturers are more like plastic surgeons—they change the skin. But for us, you might say solving problems is our driving force. So we built the Audi 5000 from the ground up. We have all the necessary equipment and testing facilities. At Audi a surprisingly high percentage of our total budget is allocated to Research and Development.

All right, what problems did you solve with the Audi 5000?

Brockhaus: Overall, we solved the problem of making a large, lively car that is comfortable to drive with remarkable handling and performance. To do this, we had to develop totally new ideas, from the first 5-cylinder gasoline engine to a new concept of interior design utilizing psychology.

Five cylinders? Psychological design? Sounds extreme.

Brockhaus: Extreme? No. Innovative, perhaps. That's my point about solving problems—we needed an engine with efficiency, like a 4 and performance, like a 6. So we were the first to make a 5-cylinder gasoline engine. We knew from psychological testing that harsh interiors could make a driver more aggressive. So we developed cheerful interiors which would be comfortable and pleasing and help the driver to remain calm and relaxed.

Were all your solutions so innovative?

Brockhaus: No. But they are equally important. For example, we not only are concerned with the exterior finish of a car, but the interior protective finish, as well. Therefore, we designed particularly large openings inside the doors, and other body panels, so that we could get sufficient layers of protective coatings into all the normally hidden body areas. Attention to a thousand minor details like these makes for a better car overall.

What's a minor detail, for example?

Brockhaus: Well, a nice little detail was the radio speakers. As an option, we developed a new radio installation that achieves a real high fidelity sound with excellent frequency response over the entire audible audio range. I doubt that many of your readers would find this important. But it mattered a great deal to us because it was an interesting challenge.

Is everything in the car brand new?

Brockhaus: No, no. We continue to use front-wheel drive, as we have for over forty years. Front-wheel drive gives excellent tracking stability in rain, ice and snow. You really should try the Audi 5000 in bad weather; you will be pleased with how it feels.

Do you think there's a better car?

Brockhaus: You can't ask the question in this form. There are cars that cost $48,000. They may well be "better," but are they realistically what one needs in normal driving situations? I don't think so.

What about cars twice as expensive as the Audi 5000?

Brockhaus: You have to ask yourself whether they can have double the worth. The Audi 5000 costs under $9,000.* in America and it's the largest German car you can buy for the money. As a matter of fact, some of my colleagues thought a much higher price would have been justified.

Then why would someone pay up to twice as much for another car?

Brockhaus: That's a very good question. Until now, if they wanted a large German car like the Audi 5000, perhaps they had to pay double. Come to think of it, they still can. But now there's a choice so we've solved that problem too.

*Suggested 1978 retail price $8,780. P.O.E., transp., local taxes, and dealer delivery charges, additional.

Secretary Ripley's comments

The view from the castle

The Smithsonian continues to be a living refutation of Nietzsche's dictum about the inevitable fate of liberal institutions

Institutions by their very nature seem to lack momentum. The words used to describe them have a formal ring: "establishment" (with its overtones of "*the* Establishment"); "foundation" (that has a connotation of solidity); "endowment" (which suggests vast funds).

"Institution" itself is solid, a bit heavy. Unfortunately, the words "penal institution" come to mind. *The Living Webster* (English Language Institute of America, 1975) defines "institutional" (p. 499) as: "a. Pertaining to or of the nature of an institution; characterized by the drabness and conformity associated with large institutions." Horrors. Is that what the Smithsonian is all about? I cannot believe it, even though *The Shorter Oxford English Dictionary* (3rd edition, p. 1018) compounds the dilemma by citing "the Smithsonian I. at Washington, U.S. (1830), etc." as an example of such a benevolent (and presumably dreary, sluggish) establishment.

Granted, then, that institutions are supposed to be solid and here to stay, why does the word have such a portentous sound? Why does it seem, like the greatest of the gongs at Nikko or the hugest of the bells in Moscow, to lack life or movement? Those of us who work at the Smithsonian think otherwise. We sense the motion.

Nietzsche wrote: "Liberal institutions straightway cease from being liberal the moment they are soundly established: once this is attained no more grievous and more thorough enemies of freedom exist than liberal institutions." But the Smithsonian by its very intent must be liberal, and it cannot be an enemy of freedom if it is to serve as an adjunct of the United States and its government.

There is a mood of skepticism about institutions in the world today. Universities and colleges are obviously institutions, just as are foundations. Yet education in the traditional sense is losing some of its appeal. Many young people no longer share the aspirations of the recent past, when everyone was to go to college in order to exercise one's inalienable rights. The national mood today is not only one of questioning, which is healthy, but also one of caution, uncertainty and perhaps implicit stagnation. Americans are usually impatient. And yet we seem to pause these days as if at an invisible crossroads.

Whatever the mood—whatever the sense of questioning the promises of the past 20 years, the chagrin over assumptions too easily taken for granted or expectations now unfulfilled—institutions must survive. They cannot remain static nor can they be dismantled as harbingers of broken promises. The Smithsonian holds its testaments of the past, its promises—some broken as evidence of the frailty that is in us all, some still unfulfilled but with time to make them come true.

Ralph Waldo Emerson once described an institution as "the lengthened shadow of one man." In the case of the Smithsonian, that man was Joseph Henry, who had boundless determination that this institution would evoke truth and increase knowledge. As a memorial to its founder, James Smithson, what could surpass this place? "What in comparison to this are local monuments, pyramids of flint, statues of brass or obelisks of marble?" What indeed? This place, this institution, is free and on the move.

S. Dillon Ripley

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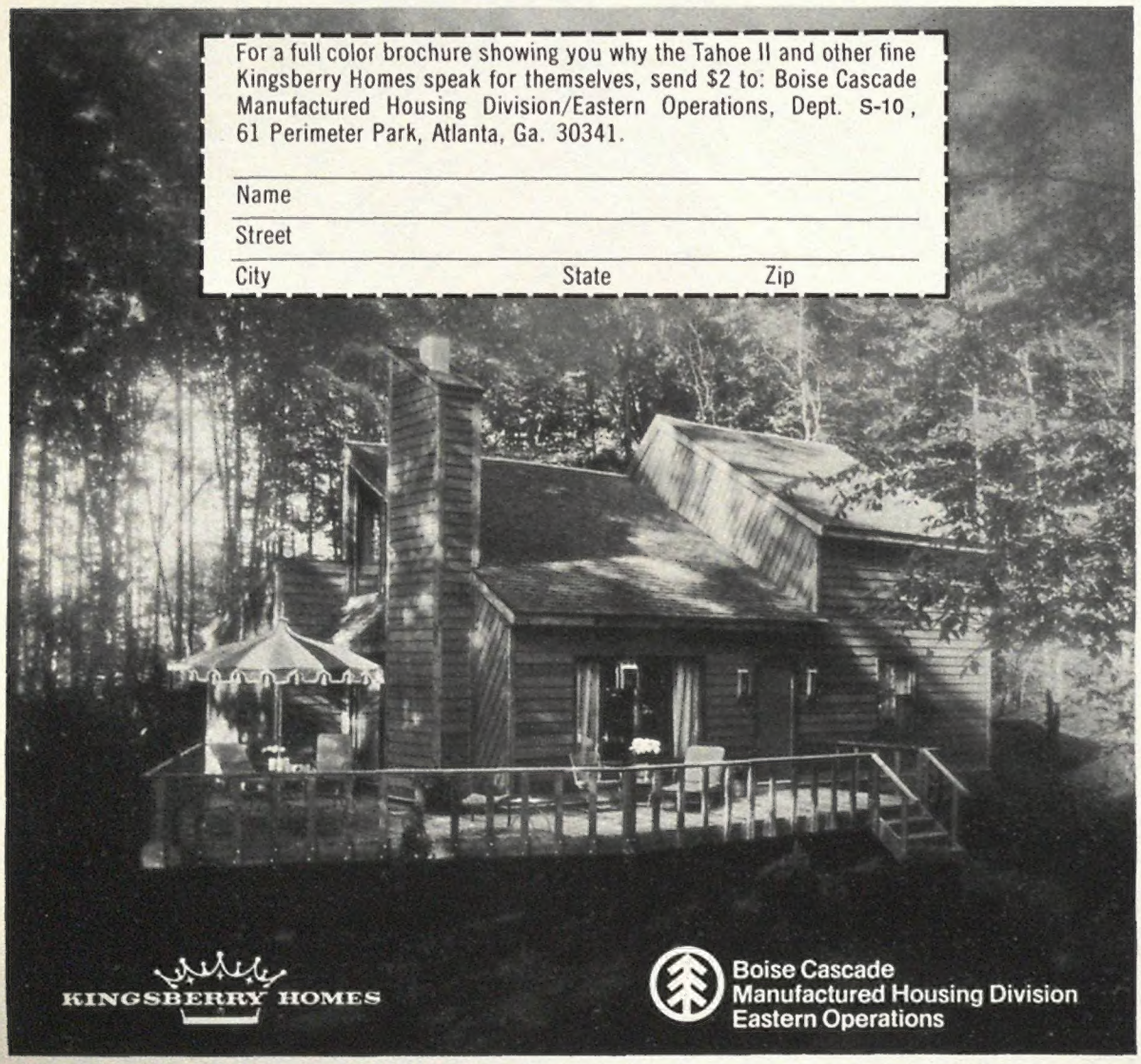

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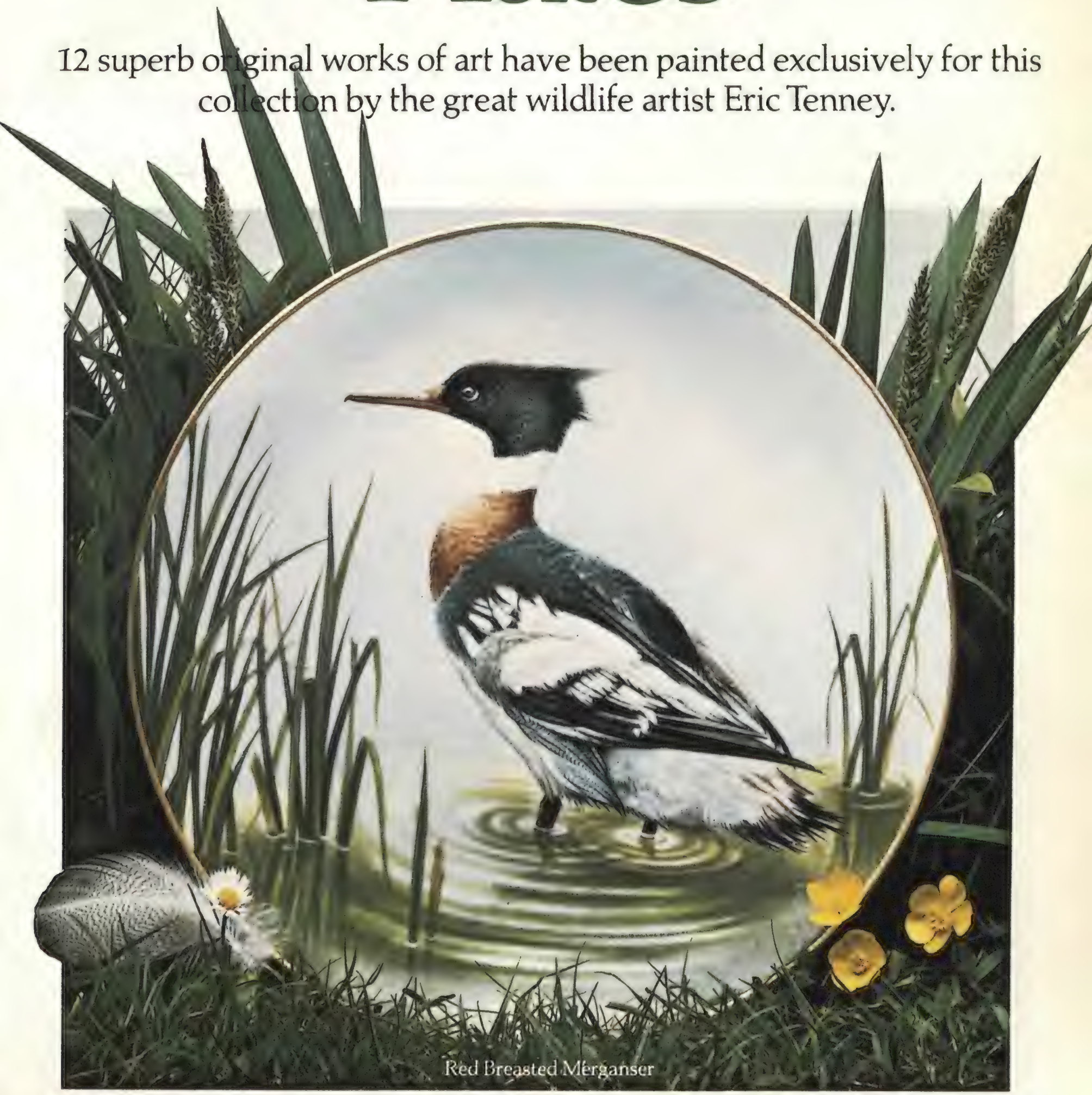
12 superb original works of art have been painted exclusively for this collection by the great wildlife artist Eric Tenney.



Red Breasted Merganser

Reduced photograph. Each Waterbird Plate is 9½ inches in diameter.

(continued on next page)

Announcing a magnificent limited edition of fine porcelain hand-decorated with 24 karat gold

Of all nature's creatures, birds surely are among the most appealing. And waterbirds in particular hold a special place in the hearts of bird lovers because of their distinctive grace and beauty.

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Oyster-catcher

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Mute Swan — Mallard

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All you need do to reserve your Waterbird Plates is return the attached reservation application. You need send no money now. You will be invoiced for each of the 12 plates as they are shipped at a rate of a new plate every other month.

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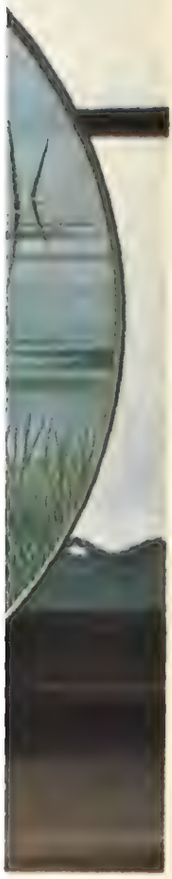

ERIC TENNEY is one of the finest wildlife artists of our time. So great is the worldwide demand for his art that he will undertake only those commissions he considers to be of unusual merit. He devoted many months to these waterbird paintings. The result is a collection of masterpieces—original art which is authentic and striking, capturing each waterbird in vivid lifelike detail.

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Must be postmarked by October 31, 1978
Limit: one set per person

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Name _____

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Smithsonian

Flamingo

White Pelican

Mallard

◀ Lift flap here

Phe com ana

Soaring s dimensio Paul Rev

To think London is of though there hap only to v mufti (tha other up at one of ments. Or great perf hall to dr a very high of an upp that rough something

On a n could hav Alec McC the Gospe tending p John Gie Bergman field, it m the most was takir nounced Street in t

And thi ing at it, was art. W was that i There is a work whe subject is thing othe on a wall

Phenomena, comment and notes

Main gallery auction room at Sotheby's, London, on next-to-last night of the von Hirsch auctions. Peter Wilson at podium; electric bid board above.

Soaring sales at Sotheby's, a fourth dimension of art; Antique Monthly, *Paul Revere's account ride high*

To think of theater when you think of London is a natural and logical sequence of thought. But not all that is theater there happens on the stage. You have only to witness two old Etonians in mufti (that is, minus the tie) sizing each other up to realize that you are present at one of the most theatrical of engagements. Or, try any pub on any night for great performances ranging from music hall to drama. For solo performances of a very high and unusual order, take note of an upper-class Englishman eating—if that rough word is capable of describing something so fine—a boiled egg.

On a night in late June, when you could have had your choice of hearing Alec McCowen's stupendous reading of the Gospel according to St. Mark or attending performances by, among others, John Gielgud, Wendy Hiller, Ingrid Bergman or the incomparable Paul Scofield, it might be arguable that, even so, the most theatrical presentation of all was taking place at Sotheby's (pronounced Suh'-the-bees) in New Bond Street in the heart of the West End.

And this may be the best way of looking at it, although the subject at hand was art. What made it so very different was that it was art for sale at auction. There is a mysterious metamorphosis at work when this happens, for while the subject is being bid for it becomes something other than what it is when it hangs on a wall or stands in three-dimensional solitude in a museum. There *is* a fourth dimension, after all, and it is not, as one had reasonably supposed, to be found in theoretical science. It is hard at hand in an art auction. We've just been looking for it in all the wrong places.

Here, then, is proposed a new theorem: there is a fourth dimension; it is in art on the block; the catalyst is investment, not to say speculation; the fourth dimension of art is money.

All this was very powerful stuff at Sotheby's for six days and nights toward the end of June (with a weekend intervening for breath-catching time). In nine sessions during those six days, the staggering collection of the late Robert von Hirsch of Basel was sold in some 600 lots for an all-time record aggregate of £18,468,300, which translates into $34,181,267.

There was tremendous power to be felt there, with the art objects sort of changing their forms before your eyes (and you had to think this or feel sorry for them, bereft of the men who made them, being used for something they were not) and an electronic scoreboard simultaneously reflecting the bids in six currencies: sterling, dollars, francs, lire, yen and marks—a blipping money clock.

But, because it was theater in the fourth dimension, it was withal a pleasant affair, the ambience easy despite the hundreds of thousands of pounds bouncing upward and onward on the board

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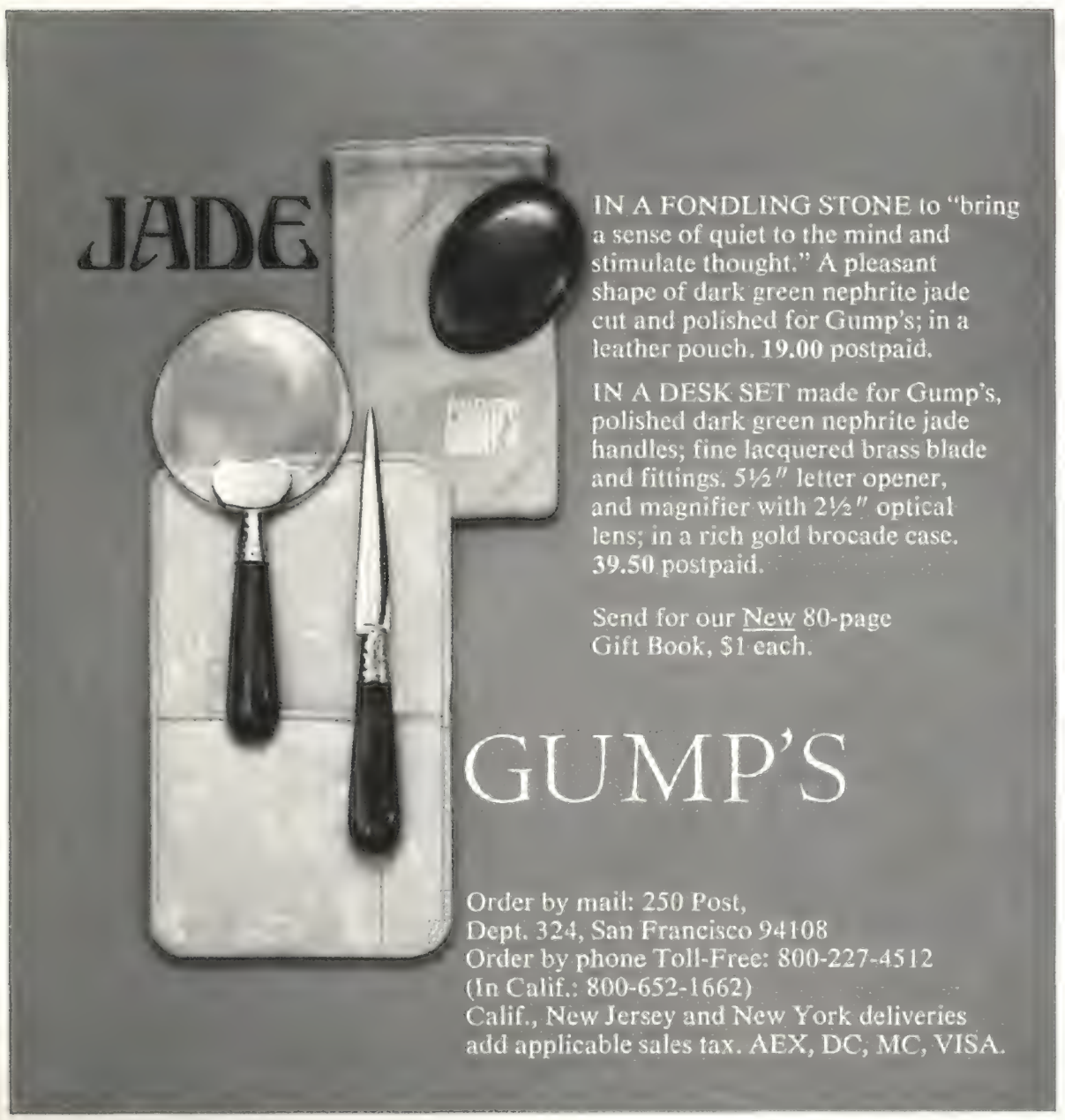
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Sotheby boss Wilson at work with stakes higher than Vegas as bidder is spotted.

into the dizzying world of high finance.

Sotheby's has been going since 1744, although not all that time in its New Bond Street buildings at numbers 34 and 35. Still, the buildings are old and honorable. The floors bend comfortably with your feet here and there, nicely covered with carpets; the lighting is clublike and warm; corridors amble around, leading to little flights of steps and on into other rooms. All around you are things people want, or have wanted, some of them as beautiful as any ever made, others merely interesting or curious.

Here are some reportorial notes jotted down on the evening of June 26, after a good dinner (a malt whiskey, a smoked trout, a grilled Dover sole, a bottle of Chablis, Stilton cheese, port) at Wheeler's, Apple Tree Yard, Duke of York Street, St. James's, to get you in the mood for one of the great theatrical presentations of the London summer season.

The main auction room, a great hall, is painted a sort of musty green. Rows of crystal chandeliers, rows of gilt ballroom chairs. A very expensive smell in the air. TV cameras—the stamp of authenticity.

In this room, having money and culture is the mark of normality. Some very fancy people are standing up—and not minding it. You take your seat modestly.

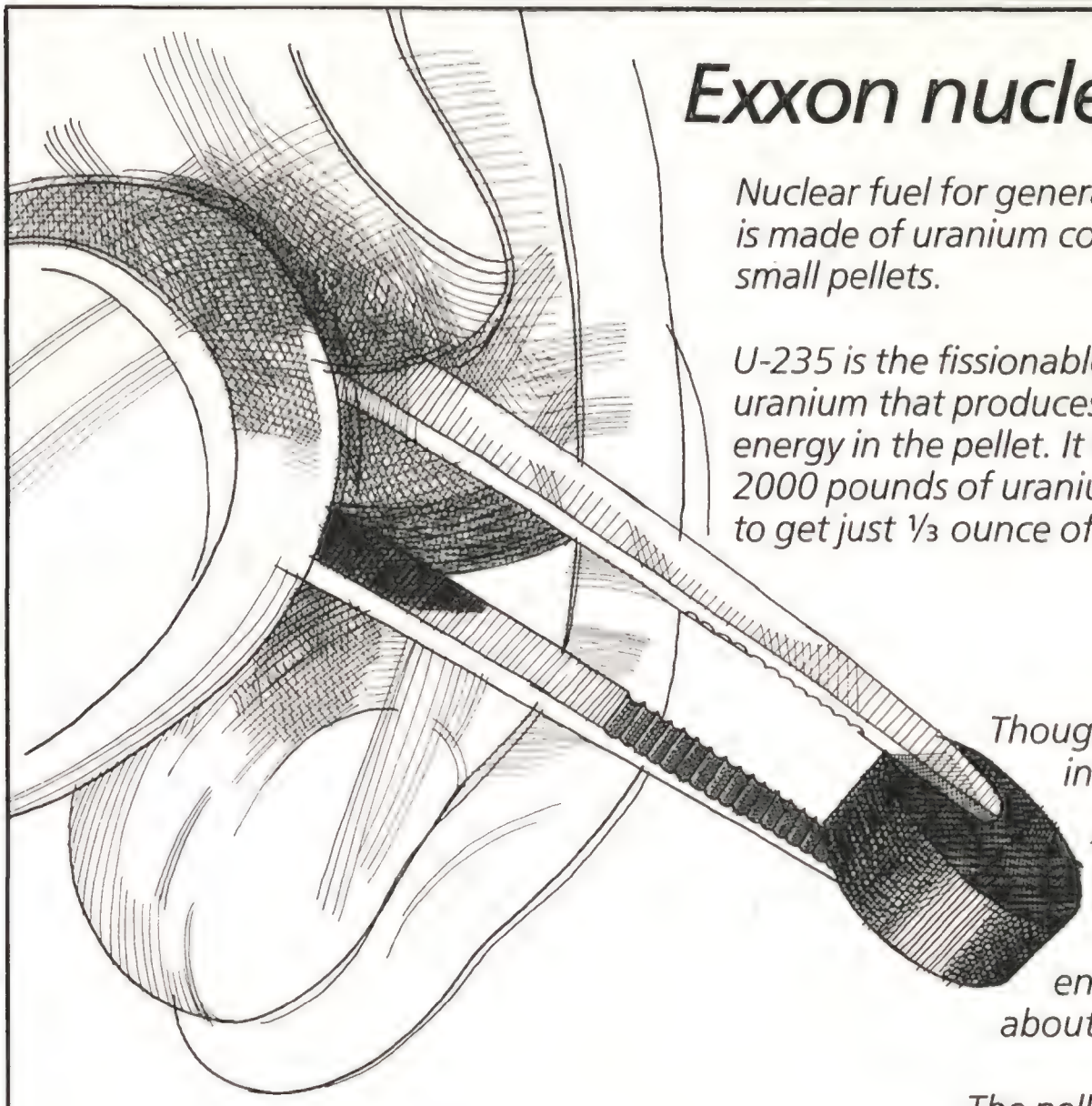
Oh, the quiet good manners of the auctioneer: a voice like Devonshire cream. He is Peter Wilson, chairman of Sotheby's. Do not be fooled—he is also a Roman senator, of a much earlier time,

EXXON ILLUSTRATED

Exxon nuclear fuel.

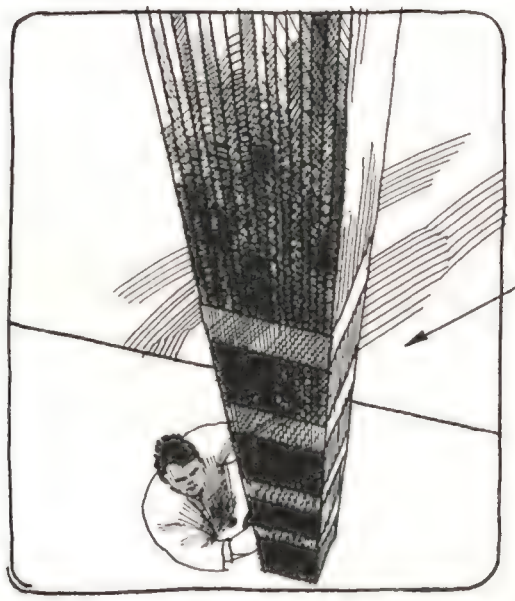
Nuclear fuel for generating electricity is made of uranium compressed into small pellets.

U-235 is the fissionable isotope in uranium that produces most of the energy in the pellet. It takes about 2000 pounds of uranium-bearing rock to get just ⅓ ounce of U-235.



Though less than ½-inch in diameter, nuclear fuel pellets are power-packed. Each pellet contains the energy equivalent of about 100 gallons of oil.

The pellets are sealed in long metal tubes or fuel rods.



The rods are grouped together in bundles or assemblies. Each rod must be exactly positioned and spaced within the assembly.

It takes some 200 nuclear fuel assemblies to make up the core of one modern reactor.

Annual electricity production from this reactor can meet the present average electrical needs of over 750,000 American homes. If generated by fossil fuels, this amount of electricity would require 10 million barrels of oil or 3 million tons of coal.

By 1990, nuclear fuel could provide about 30% of total U.S. electricity demand.

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Hot lines lead directly to main auction room. Taking phone bids from round the world, Sotheby assistants then flash them instantly on board for all to see.

of course. "Yours, Madam," he concludes.

The process is hypnotic: 280, 300, 320, 340—and then you realize that he is mentioning figures in hundreds of thousands of pounds.

An interlocutory nod, "Your bid, Sir." This is prompting in a rarefied state.

The standing crowd holds the catalogs as if they were hymnals, and they are. They cost £12, almost $24, for this night's presentation. The previous record auction was last year's Sotheby sale of Lord Rosebery's (a Rothschild) estate, Mentmore, which brought $10.5 million. A set of the catalogs for that auction, having become auctionable themselves, was sold recently for £150—at Sotheby's rival, Christie's (founded 1766).

"Against you, Sir" is the most delicious soft sell in the world. And that's how it goes for this little piece, from 50 to 70 thousand *pounds*.

Matisse, lot number 751, "oil on canvas, signed and dated '40, 31 7/8 in by 39 7/8 in," *Nature Morte à la Dormeuse,* what a beautiful thing it is. 230, 240, 250, 60, 70, to £310,000 or $586,000. The little ivory hammer comes down. Tap. Next lot.

Things haven't gone so well on the block (as they say) since the swinging days of the Tower of London.

And they are going well on our side of the Atlantic, too, in the business of art as money as investment as, oh well, an inflation hedge. Here, to give you an idea, is last season's wrap-up assessment from Sotheby Parke Bernet (rhymes with pet) in North America. This branch realized $112 million in auctions running day and night for anything that is auctionable, which is everything, but mainly paintings, sculpture, furniture, jewelry, stamps, silver, books, rugs, drawings, prints and autographs.

North American president and chief auctioneer John L. Marion summed it up this way: "We can thank American bidders for putting us into a whole new orbit in attracting fine property for sale." It was a year in which George Caleb Bingham's *The Jolly Flatboatmen* brought $980,000. That was just one of more than 200 other auction records set during the season, including $70,000 for Paul Revere's expense account for his Boston Tea Party ride to New York and back. (Revere's expenses, by the way, came to £14 and a couple of shillings, or 190 of today's dollars, whatever they're worth at the moment.)

What has happened is that Paul Revere's little listing of what it cost to get around with a horse those days has itself been converted into currency. What it was suddenly becomes much less important than what it is, and what it is in this form of transmutation is something people will spend a lot of money for.

And so we are here confronted, but not for long, with how much something costs as against its real value. How much is a Rembrandt painting worth? How much can a Rembrandt painting be sold for? is the better way of asking it. The

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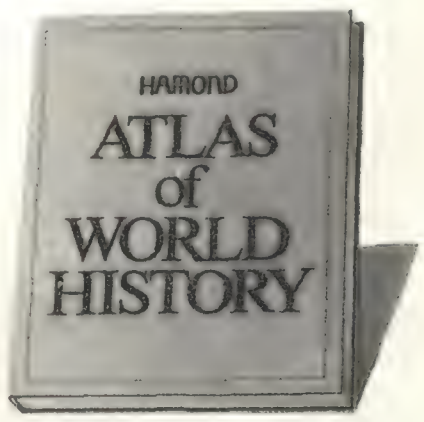

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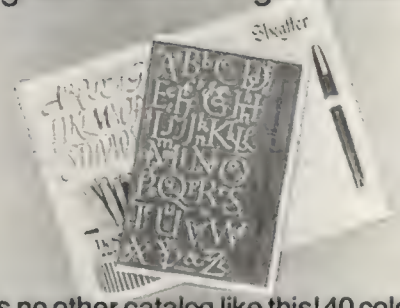

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S-8

answer is probably more than was spent for it the last time it was for sale. What an object costs at auction becomes, at that instant, its monetary worth.

Even so, here is something nice: when it is art of quality, something created out of passion and skill, the reason for its money value is the artist and what he or she—and no one else—can do.

An artist, naturally, has put it best. Ernest Hemingway, in *Green Hills of Africa,* wrote: "A country, finally, erodes and the dust blows away, the people all die and none of them were of any importance permanently, except those who practised the arts. . . . A thousand years makes economics silly and a work of art endures forever, but it is very difficult to do. . . ."

That is why there is more talk these days than ever about preserving the patrimony of a nation by keeping its art at home. That is why, in England, the public is invited to subscribe to campaigns to buy for public collections those works of art in danger of being bought by foreigners for export. The fact is that, in so many cases, the works in question aren't even from the countries trying to retain them. In actuality, if you will, they are somebody else's patrimony.

And so we return, and about time, to the universality of the artist and the fact that it doesn't matter at all if the work

This happy little piece, four inches high, is an early 12th-century English gilt

of art was made by an Italian in the 15th century or a Frenchman in the 19th or an American in the 20th. If it is art, it remains what it is for all to respond to.

Given this pure response, there are nevertheless responses of another kind, and we are back to auctions and sales.

"In response [that word again] to the tremendous growth of interest," a recent press release says, "in the field of art and antiques . . . and to meet the ever-increasing demand for more comprehensive news coverage in this area, *Antique Monthly* (with a circulation of 100,000, the largest journal in the field), announces that it will now be expanding to two editions a month."

Back in London, a little English 12th-century gilt altar candlestick, four by eight inches in dimension, has been bought at the von Hirsch sale for £550,000, or about $1,039,500. It's nice that an English group bought it. Which English group? The British Rail Pension Fund. An investment, you see. It will be exhibited at the British Museum, which is a curious place for keeping one's assets.

If it were not for all of this, you might have thought that the art of merchandising was a particularly American expression. And yet, remember that before there were Macy's and Gimbel's there were Sotheby's and Christie's.

—Bennett Schiff

altar candlestick base. It was bought as investment by British Rail Pension Fund.

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Letters to the Editor

Tiger-saving operation

Dear Sir: No doubt you and your author-photographer Peter F. R. Jackson will be deluged with well-deserved applause, especially for the photograph of the tiger (apparently female) on your August cover.

Perhaps you would give equal time to my photograph of a jaguar [see below].

Ira Richolson
Arlington, Virginia

This jaguar was caught napping at the National Zoo.

Dear Sir: One of the tiger's basic needs is an area of peaceful jungle where it can lie undisturbed during the day. This is only one reason to question the validity of the Smithsonian/World Wildlife Fund tiger study in Nepal.

What you are describing is the work of a group of jungle-innocent foreigners making life miserable for a remnant handful of animals in the Royal Chitawan National Park. These people apparently believe they are studying the life of the tiger in the wild. What they really are studying is the special behavior of a special few tigers trying to survive in a limited area, amidst the constant pressure of dart guns, low-flying aircraft, radio-equipped collars, patrolling elephants, job-hungry shikaris, and a gaggle of Ph.D. aspirants from the United States.

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Despite all the gadgetry (as I read your article), the Chitawan project has not produced any data on the tiger that you can't find in the works of Jim Corbett and others. How much more productive it would be to quit harassing the Chitawan individuals and devote time to the recording and collating of tiger lore from among the many living experts, while they and the last few wild tigers yet survive.
Fitzhugh Turner
Austin, Texas
A Smithsonian spokesman, who has first-hand acquaintance with the tiger-study project, makes the point that managing a national park system cannot be based on speculation or lore. The project has already confirmed many observations of naturalist-hunters, but it has also separated fact from myth. There is no constant harassment of the tigers, but careful research and monitoring have revealed much basic data on mating, feeding, territorial patterns, physiology and mortality. The knowledge gained by the project of the number of tigers and distances they traveled had one early, beneficial effect—expansion of the Chitawan park. Ed.

Dear Sir: I'm sure you will receive a landslide of requests for reprints of your cover. I had already planned to frame the cover when I saw your poster offer. Thank you for your foresight.
K. V. Helbing
Bonita Springs, Florida
We have, indeed, had an avalanche of requests, and are producing additional posters to meet the demand. All orders are being filled as quickly as possible, but we ask for your patience. Ed.

White House Fellows

Dear Sir: According to Richard L. Williams' article concerning the selection of White House Fellows, you've got a better than even chance to become a fellow if you're male and less than a third of a chance if you're a lass, alas.
The Rev. Charles W. Hendrickson
Brooklyn, New York

Dear Sir: Out of the 15 White House Fellows chosen, only three were women. The author does not tell what percentage of the original 2,026 applicants were women, nor does he say how many of the 110 semi-finalists were women. I'd like to know how those percentages compare with that

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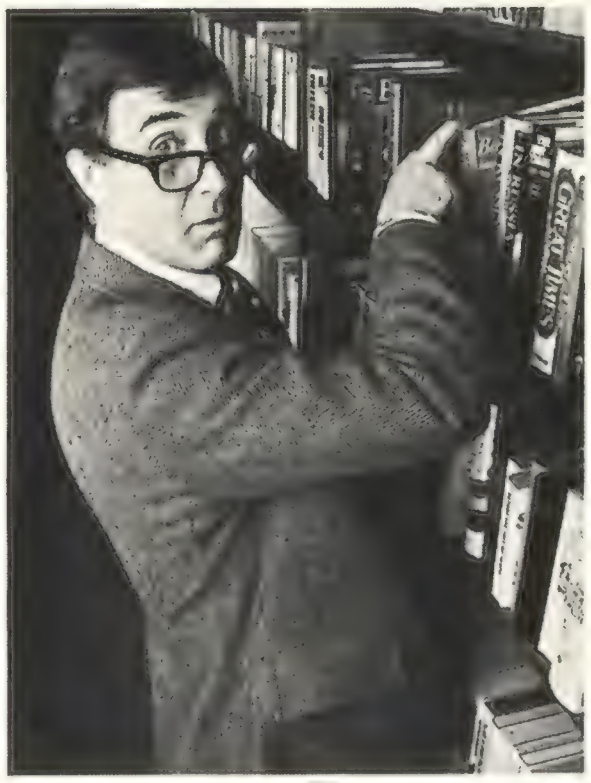

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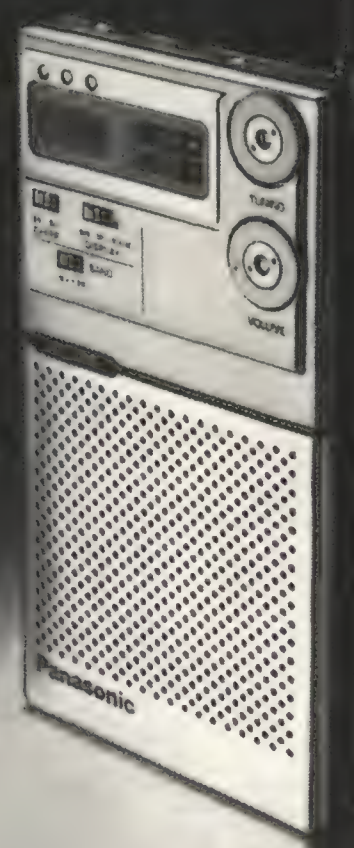

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Kathie Porter
Grand Rapids
Of the total applications, 32.7 percent were women; 31 percent of the regional finalists and 30.3 of the national finalists were women. In each of the past two years, only three women were chosen. Ed.

Dear Sir: While sexually and racially integrated, the 15 finalists are otherwise not representative of our society. There are no representatives from labor, agriculture or small business. Undoubtedly, the individuals are competent, but their input to government must be restricted by their backgrounds, as must the benefit of their experiences upon termination of their service.
Norman L. Zemke
Southfield, Michigan

Bronze-Age tombs

Dear Sir: Your article, "Cultural change in Bronze Age," did not make clear that author Donald J. Ortner's excavations in the Bab edh-Dhra cemetery are only a part of the much larger Expedition to the Dead Sea. This includes excavations of the town site, of the nearby Early Bronze town of Numeirah and of the whole Ghor region on the southeast corner of the Dead Sea. The expedition is under the direction of Drs. Walter E. Rast and Thomas Schaub, and is sponsored by the American Schools of Oriental Research. Furthermore, more than 50 tombs in the cemetery were excavated and studied by my late husband, Dr. Paul W. Lapp.
Nancy L. Lapp
Pittsburgh
Dr. Ortner's article was an account of his own experiences, but he did refer to the work of Drs. Rast and Schaub. We also had as our first listing in "Additional reading" an article by Dr. Lapp: "The Cemetery at Bab edh-Dhra', Jordan," Archaeology, *April 1976.* Ed.

Museum of the American Indian

Dear Sir: In the article by Vine Deloria jr. on the Museum of the American Indian, there was an error in the caption under the photograph of the Sitting Bull medicine drum, which stated, parenthetically, "*not* the one who beat Custer."

The original owner of the drum was, in

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fact, *the* Sitting Bull, Tatanka Yotanka, famous leader of the Hunkpapa tribe of the Teton (Lakota) Sioux, who was involved in the Battle of Little Bighorn. It is well documented as part of the collection of 11 items that belonged to Sitting Bull, acquired by the museum in 1972.

James G. E. Smith
Curator of North American Ethnology
Museum of the American Indian
New York

Dr. Smith is correct. We had confused Sitting Bull, the Hunkpapa Sioux leader, with Sitting Bull the Minor, an Oglala Sioux (see below). The latter was not so famous, but he was appreciated by President Ulysses S. Grant enough to be given a rifle out of "friendship and esteem." Ed.

Famous Sitting Bull (Hunkpapa Sioux)

Sitting Bull the Minor (Oglala Sioux)

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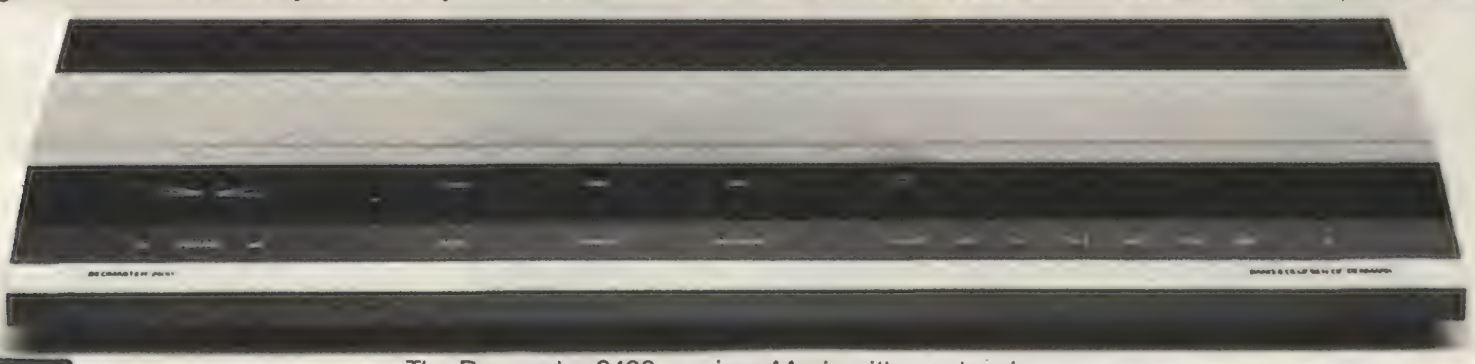

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Dear Sir: With regard to Vine Deloria's opening paragraphs, my experience with native Americans is that they *do* enjoy seeing artifacts from other culture groups. A happy, though unanticipated, result of many of the early collectors' work is that scholars, including native Americans, can research documented specimens from cultures that have changed radically.

As to the disposal of their family heirlooms, they do not seem to be very different from other Americans. Space or money is needed for something else; the children aren't interested in old things; changing styles dictate a new outfit. An item, be it a warbonnet or a Chippendale chair, is sold, sometimes wisely and sometimes not. Because of the tremendous interest in their crafts and art, native Americans are among the few people who can sell their old clothes and footwear at a nice profit.

James A. Hanson
Native American Training Coordinator
Smithsonian Institution
Washington, D.C.

Peddler of quinine and alpacas

Dear Sir: Your article on Charles Ledger mentions Colonel Fischer's exploits during World War II to recover cinchona seeds in the Philippines and shipment of the precious seeds on the last plane to Australia. In 1942, some 27 collections of Fischer's cinchona seeds were sent to the U.S. Department of Agriculture. Using special techniques for sowing cinchona seedlings in pure sphagnum moss, some two million of them were eventually flown to Central America. The use of sphagnum moss for large-scale production of plants when soil is not acceptable, either because of quarantine laws or weight, is a remarkable spin-off of the cinchona story.

John L. Creech
Director, National Arboretum
Washington, D.C.

Dear Sir: The remains of Charles Ledger lie in an unmarked grave in Rookwood Cemetery in Sidney, Australia, but we hope that this situation will soon be put to rights. I understand that the National Trust plans to put up some sort of plaque to commemorate his name.

Charles Ledger
Oldham
England

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Around the Mall and beyond

The mechanical manikin in the repetitive stroboscopic photograph at the right dates from the late 16th century. He displays the skilled clockwork machinery of the Renaissance era.

This little automaton—the picture is more than half his full size—was acquired by Dr. Otto Mayr, acting director of the Smithsonian Museum of History and Technology, who hopes to round up more robots and perhaps have a hall for them some day. This one is believed to hail from Spain (the only other similar automaton resides in Vienna). He went on display in the Hall of Timekeeping in the heat of July, which may explain why he is unfrocked, his joints exposed, his machinery as naked as the day it was fabricated.

I went to welcome him to the Institution and found that there is a film of him in action, which can be set off by pushing a button. Now you see him being wound up, his ratchets clicking into place, and then turned loose. Dressed for part of the film, he wears the robe of a Franciscan. I believe he was supposed to carry a cross and a rosary, but he's apparently left them back in the refectory.

The little monk's feet go through walking motions, though the movement of the figure is supplied by three small wheels hidden under his vestment. He moves forward, stops, turns and heads off in a new direction. His right hand beats his breast in a sort of tragic gesture, while the left rises and falls with vehemence. His head turns from side to side and also nods. His mouth opens for what must be terse dictates, judging from the way it clops shut again. The movements add up to an impression of petulance.

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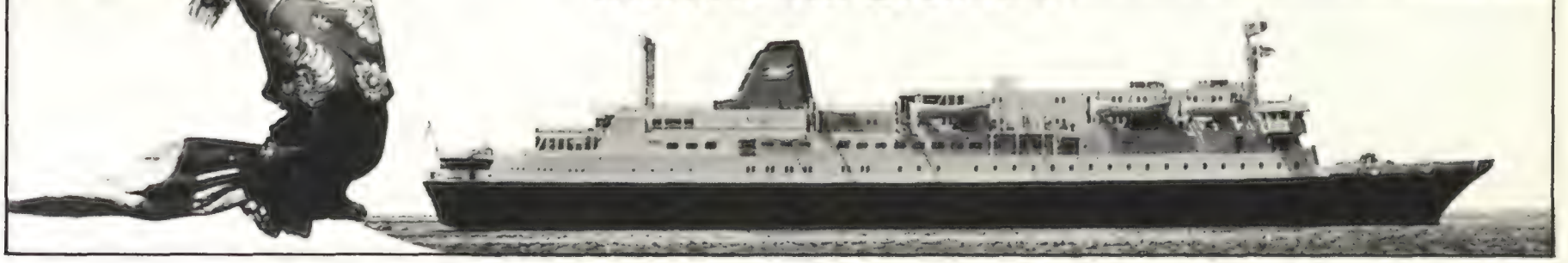

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I watched this fussy, bad-tempered little monk tottering around the abbey, obviously inveighing against the stupidity and laziness that surrounded him, and I was thankful that I was not a novice, receiving his sharp words and peevish little gestures. To get a better-humored idea of automation I moved to the clock exhibit to savor the turning of the hour. Some knowledgeable sightseers were fast gathering, and I hastily joined them.

This display includes a composite replica of a vintage European tower clock, with four different and distinct faces. The clockwork itself is late 18th-century American but the Renaissancelike automaton was actually made recently, in England. The clockface scene that charmed me evolves around a seated king. Below him is a pastoral view of fields and mountains; above is a small bell with a page boy standing by it. And in the topmost tower, above the throne, is a door.

The magic moment arrived. The door opened and a cock emerged and crowed hoarsely. That signaled the opening of a door at the king's right. Out came three jesters playing musical instruments and being chased by a barking dog. They passed in front of the throne.

Then, down on the farm, two rams butted each other resoundingly. At that, the page boy sprang into action, swinging a mallet against his bell the requisite number of times. That ended the performance. The king seemed lost in reverie throughout. I suppose he's seen it so often his mind wanders.

It was a hot summer, but the Mall carried on imperturbably, hosting event after event. During the Fourth of July holidays there was Jewish folksinging, 18th-century shoemaking, toy-soldier casting, a fife and drum corps, jugglers riding unicycles and finally a display of public oratory. This last intrigued me because oratory was originally as much a tradition of Independence Day celebrations as huge firecrackers, now illegal in many areas. Even I can remember listening to oratory on the Fourth, my eyes glassy with boredom, until the rising morning heat silenced the speaker and I was free to get back to my five-inch salutes—"enough to put a GAR cannonball spang through Oddfellers Hall," as my father's friend Slocum once admiringly remarked.

But the Smithsonian occasion was bolstered by professional actors. My inform-

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ant says there was a Susan B. Anthony who could have stepped right into an ERA rally and a fiery Frederick Douglass.

Since then, the Mall has had other musical groups—and boomerangs and Frisbees. And now, as October rolls around, the 12th annual Festival of American Folklife opens for five days (see Highlights), October 4 to 9. It will feature the folkways of certain Mexicans, Mexican-Americans, Pueblo Indians, and those of coal- and oil-producing areas, and the watermen's communities around Chesapeake Bay. Obviously it will be a great chance to see potters at work, listen to songs, watch dancing and marvel at traditional skills like sailmaking, model shipbuilding and oyster shucking.

The date of the folk festival has been moved on to October from the middle of summer for a number of reasons. Weather, of course, is one. Also, organized school groups will benefit more than in the unstructured days of summer vacation. Moreover, the site of the festival has been moved down to the area of the Museum of History and Technology because the old region, near the Reflecting Pool, was right under the traffic pattern for National Airport. Nothing upsets an Appalachian fiddler in the middle of his gig more than a 727 howling in to land.

One thing that all folk festivals are famous for is food, and this one will be no different. But I love the story of the woman of Eastern European background who was approached by the Smithsonian festival people last year and asked to do some cooking. She was thrilled. She said she was so fortunate because she had just finished a course in French cookery and could come up with super Cordon Bleu menus. She couldn't believe it when the Smithsonian organizers insisted that all they wanted was that plain old Eastern European stuff she whacked out when she didn't have to put on the dog.

Speaking of filling the inner man, the other night I drank half a glass of ants. This puts me with those Aztecs that my old friend Jake Page wrote about again in his Phenomena column for August—the ones that ate insects, dogs and reptiles as well as an occasional dish of people.

I have this habit of alleviating my midnight thirst by sipping something moist and nonalcoholic. Not water. I haven't drunk water for 42 years. That was when it first started to taste bad. Instead, I ar-

Voice in the Wilderness.

"Some people say we need more Wilderness, but you can go for 15 days in this area without seeing another person."

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And alone is what Bob often is. In Idaho's vast Wilderness areas, he can go for weeks at a time without seeing another soul.

In an effort to measure the attitudes of people who, like Bob Rears, live close to the Wilderness, the Idaho Forest Council interviewed residents of the state last year.

They found that 72% of the general public questioned felt there was no need to expand Idaho's Wilderness (about 14% of Idaho's national forestland). This is the opinion of people living in a timber-rich state.

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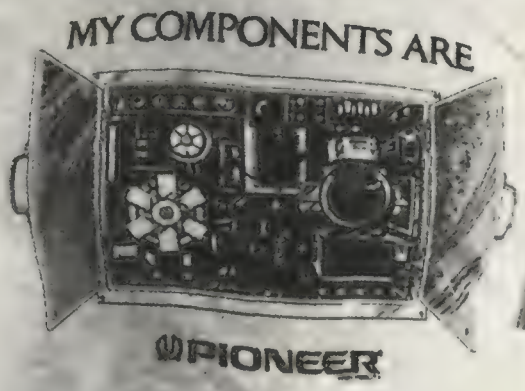

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range a cool, pleasant concoction at my bedside, awaiting that sleep-dulled craving that comes upon anyone who has dined well. On this particular night I glugged it down in the dark, felt something oddly solid about it, turned on the light and discovered that I had decimated a colony of those tiny, purposeful little house ants—the kind that stride across your kitchen counter to where you spilled last night's caramel sauce.

Those ants are either *Monomorium pharaonis* or *Solenopsis molesta.* One can't be sure unless one does a microscopic analysis, which I don't much want to do. Whatever their name, I have nothing against them, and I didn't really mean to swallow so many of them. A dozen or so, maybe, but not annihilation.

I'm not at all like my father's friend Slocum who developed this thing about ants in his homemade maple syrup. Slocum used to glop his syrup on just about everything he ate and, ordinarily, when he discovered *pharaonis* or *molesta* or any of the other species in there, he'd chuck the whole dish out. But when times were bad, according to his remarkably nimble memory, he'd eat it all down, ants and all, in the belief that he was picking up some much-needed protein. "Back in 1933," he told me, "I got so pinched that if they wasn't ants in the syrup I would, by-the-Godfrey, go out and *dig* some!"

My little ant victims find their way into houses through minute cracks. They are ubiquitous and dedicated, as I realized on a late spring day over at the Museum of History and Technology. I had received word that the bees were back on display in the agriculture exhibit, and since the bees have suffered a lot in the past—banned from the White House lawn by Mrs. Coolidge when they swarmed there in 1926, falling into a frenzy of frustration when their queen was barred from the Smithsonian hive in 1932, taking off for parts unknown in 1950, invading an air conditioner in 1962, getting an overdose of insecticide a year later and an epidemic of moth larva in 1977—after all that, I guessed I should drop by.

There the bees were in their glass-walled hive, working away at the honey business and bustling in and out of their tunnel, which ends in a mail-slot-shaped outlet on Constitution Avenue. And with them were my ants. Hundreds of them, small and determined as ever, trooping

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silently and steadily into the museum. They'd found a way to avoid entering the hive. They were parading straight into Agriculture Hall and from there they were obviously headed right across the ground floor, and from there all through the museum. And now they're marching all over the Mall until they find me. That's what I get for swallowing 1,347 of them in the middle of the night.

The bees, incidentally, disappeared again a little later on in the summer. Maybe the ants got to *them,* finally.

I learned of another swarm from a young visitor to the Insect Zoo, so hurried over to the Museum of Natural History to investigate. I can report that, at the time of writing, bees were packing the hive *there* to bursting point. The ants better get after them, instead of me, or we'll have severe overpopulation.

The East Building of the National Gallery (SMITHSONIAN, June 1978) has now been opened to the public for four months, has welcomed more than 1.4 million visitors, including me, and has picked up roughly the same number of fingerprints, including mine, on those knife-edged angles that distinguish I. M. Pei's design. It is absolutely impossible to walk past those sharp angles of marble or concrete—each resembling the cutwater of an ocean liner—without giving them a feel. The result is that, just at a comfortable raised-arm level, every angle has turned a sort of gummy brown. I think it's good—indicates the human touch.

A corridor from the new building leads to a very fine underground cafeteria. I traversed it, and then ascended to the marbled regalness of the National Gallery's West Building.

Visitors don't often look down as they pass through those splendid halls so rich with painting and sculpture. If they did, more of them would discover a large and beautiful marine fossil on the main floor. It's a mollusk—an orthocone nautaloid cephalopod—according to Dr. James Mello, assistant director of the Museum of Natural History, who is supposed to know all about stuff like this, and it was found in a slab of slate-gray limestone. Every day it gets walked over by hundreds of feet while hundreds of eyes are on the walls all about.

Orthocone can be found in the hall that . . . no, I'm not going to tell you. You can go and discover it for yourselves.

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(1) Walking is the most *efficient* form of exercise . . . and the only one you can safely follow all the years of your life.

(2) Exercise can enable your body to maintain a *vital reserve* which has a protective effect during stress.

(3) Exercised *bones* do not demineralize. As a result they are far less likely to break or lose their range of motion.

(4) Exercised *lungs* still exhibit the emphysema-like changes of age, but are far less diminished in their capacity compared to the lungs of sedentary people.

(5) Exercised *cardiovascular systems* show a similar maximum preservation of function.

(6) The benefits of exercise in preventing or correcting obesity are striking.

(7) Late-onset diabetes is almost entirely reversible by exercise if you are overweight.

(8) Daily exercise permits greater food intake and better blood circulation, thus improving each body cell's nourishment while preventing obesity.

(9) The physically impaired, particularly the arthritic, can perhaps benefit the most from exercise . . .

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The Michael C. Rockefeller wing of the Met: a father's memorial

In 1930s, when he began his great primitive art acquisitions, the collector relied more on his inner feeling than on expert appraisals

Since his retirement from public life in 1977, Nelson Rockefeller has devoted much of his time to preparing for publication a series of volumes on his extensive collections of the arts of the world.

Following, adapted for SMITHSONIAN, *is Rockefeller's introduction to the volume by Douglas Newton,* Masterpieces of Primitive Art, *to be published this month by Knopf ($30). The Rockefeller collection will be installed in the Michael C. Rockefeller Memorial Wing of the Metropolitan Museum of Art, New York, when it opens late in 1979. Michael, Nelson's son, who had made contributions to the collection, died at 23 while on an expedition to New Guinea in 1961.*

Peabody Museum, Harvard University

Michael Rockefeller with Asmat tribesmen in New Guinea, where he loved to be and where he died.

There are inner forces in one's life that sometimes seem to be unrelated to conscious thought. This can be true of appreciation as well as creation of art.

Much of so-called primitive art was created as a direct response to strong feelings. My appreciation has been a direct response to the power and beauty of that creation—in different forms and by different peoples—but always an expression of those inner forces interpreted with compelling directness and simple beauty.

Gertrude Stein understood this very well. In her book on Picasso, the artist she (and I) most admired, she explained the basis of his struggle as he broke from tradition in the early 1900s: ". . . with the exception of some African sculpture, no one had ever tried to express things seen not as one knows them but as they are when one sees them without remembering having looked at them."

That to me captures not only the essence of Picasso's work, but the quality of primitive art which had such an impact on Picasso—as well as on many of the other young painters and sculptors who were destined to become the leaders of the modern art movement.

By the 1920s, a few American artists and adventurous collectors had discovered the strength and beauty of primitive art and had come to realize the importance of its place in the long history of human creativity. My mother was one of this small group of collectors. She was an extraordinarily aware and sensitive person who followed her own instincts and not convention. Fortunately for me, she had a small art gallery of her own in our house on 54th Street in

At home in Pocantico Hills, New York, Mr. and Mrs. Rockefeller display Michael's Asmat shields.

Made of plank root of the mangrove tree, these ceremonial objects are named for ancestors.

Color photographs by Lee Boltin

New York City. I still treasure the various pieces of African sculpture she had there along with the modern art; they are part of my private collection today.

I was fortunate to be able to acquire—through osmosis, I guess—an appreciation and enjoyment of art in various forms. It was not a conscious intellectual effort on my part, or a matter of discipline. Thus, primitive art never seemed strange to me.

The first piece that I collected personally was a beautiful and simple wooden bowl which I found in Hawaii on a trip around the world in 1930. I couldn't resist it—and I still get great satisfaction from the shape of the bowl, the grain of the wood, and the warm, soft patina that came from centuries of loving care. Later that year, in Bali, amid the splendors of nature and a joyful people, I found a small, old wooden figure of a woman—carved simply, and expressing great feeling (both, opposite at far right).

I was beginning to learn the excitement and thrill of discovering beautiful things on my own.

In Sumatra, we drove through tropical jungle dotted with clearings of little villages with thatched houses, their ridgepoles upturned. In one, I discovered and purchased some interesting pieces: a dagger and a lute (right).

That trip provided unique opportunities to visit the great and beautiful cultural monuments of early civilizations, such as Angkor Wat, Angkor Thom, the Ajanta caves in India (SMITHSONIAN, August 1976), the greatest of all Indonesian Buddhist monuments at Borobudur (SMITHSONIAN, October 1976), and the remains of pre-Neolithic Mesopotamia and Judea.

In 1933, we spent three memorable months on another continent, South America. Then, in Mexico, we visited the monumental remains of the early Mayan civilization. We had a chance to pore over the great collections of Olmec, Toltec and Aztec pre-

The first objects of primitive art Rockefeller bought were acquired on a round-the-world trip in 1930. They are a dagger and wood lute (left), both made by Batak tribesmen of Sumatra; seated female (above) of carved wood, Bali; and, below, a simple Hawaiian poi bowl which he still especially prizes.

From perspective of the wearer, this is an enlarged view of a filigree gold nose ornament, 4 3/8 inches wide (Mochica period, Peru, about A.D. 100). Mochica culture flourished on the north coast.

Columbian art with our friends, Miguel and Rosa Covarrubias and Diego Rivera. As artists, they were deeply influenced by the art of these early American civilizations. I found myself captivated by the power and exquisite refinement of these works. It was a most exciting and exhilarating experience, opening up new worlds—worlds little known and little appreciated at that time outside Latin America and anthropological circles.

By now I was rapidly gaining a more catholic understanding of the word "art." I saw "art" as widely varying expressions of individuals—individuals from all parts of the world and from all ages, with strong feelings and great creative capacities.

Unfortunately, at that time only museums of natural history collected primitive art, and then primarily for its ethnological interest rather than its esthetic qualities.

I had been on the board of trustees of the Metropolitan Museum of Art for some years and was concerned that the Metropolitan showed no primitive art. Having been intrigued for a long time by the reports in the *Illustrated London News* of the joint digs carried out by the British with Egypt and other Middle Eastern countries, I got the idea of a combined expedition of the Metropolitan and the American Museum of Natural History, jointly with various countries of Latin America, for pre-Columbian archaeological digs.

I enlisted the support of another young trustee of the Met, Bill Harkness, and we offered to finance the program. The American Museum of Natural History was enthusiastic—but the Metropolitan wasn't.

Preserving mummies from Paracas

For some years I continued the struggle to put the idea across. I remember that on a trip to Peru in 1937 I met Dr. Julio C. Tello, the leading Peruvian archaeologist. Dr. Tello had made the mistake of getting into politics and being elected a senator, in addition to his work in archaeology. When I arrived, there had been a change in government and he was not only out as a senator, but also as the head of the government's archaeological program.

I found Dr. Tello in a state of desperation. He had close to a hundred mummies from Paracas—one of the great pre-Inca desert burial grounds—which he had brought down to Lima, on the coast, where it was very damp. He had not had a chance to unwrap these mummies, which were enveloped in beautiful textiles representing all known weaves. The problem was that the materials had absorbed salt from the desert sands over the years and were now beginning to show signs of rotting, owing to the moisture of the coastal area.

Michael C. Rockefeller memorial

Helmet mask, Malekula Islands, New Hebrides, is made of wood, straw, tusks and glass; 26 inches high.

Yet he could not unwrap and preserve either the mummies or their wrappings because he had no funds.

I gave him money to start work on the unwrapping of these priceless treasures. Later I went to see the new president of Peru. President Prado understood the situation and renewed the government's support of Dr. Tello.

In the course of our discussions, I told Dr. Tello about my plan for a combined expedition. He was enthusiastic about the idea, and sent back two mummies with me, to illustrate to the Museum of Natural History and the Metropolitan what could be accomplished by inter-American collaboration.

Scientists at the American Museum of Natural History were very excited and handled the unwrapping of the mummies, but the Met remained uninterested. After this rebuff, I gave up the idea and decided to collect primitive art more actively myself.

At that time, I was also a trustee of the Museum of Modern Art in New York. It was the first art museum in this country to recognize primitive art and its influence on modern painting and sculpture. The museum already had started a series of exhibitions to demonstrate the cultural importance of these works and this relationship.

In 1939, when I became president of MOMA, I organized an exhibition of "Twenty Centuries of Mexican Art," held in 1940. In 1946, the Museum showed the "Art of the South Seas," and in 1954, the "Ancient Art of the Andes."

A first museum of primitive art

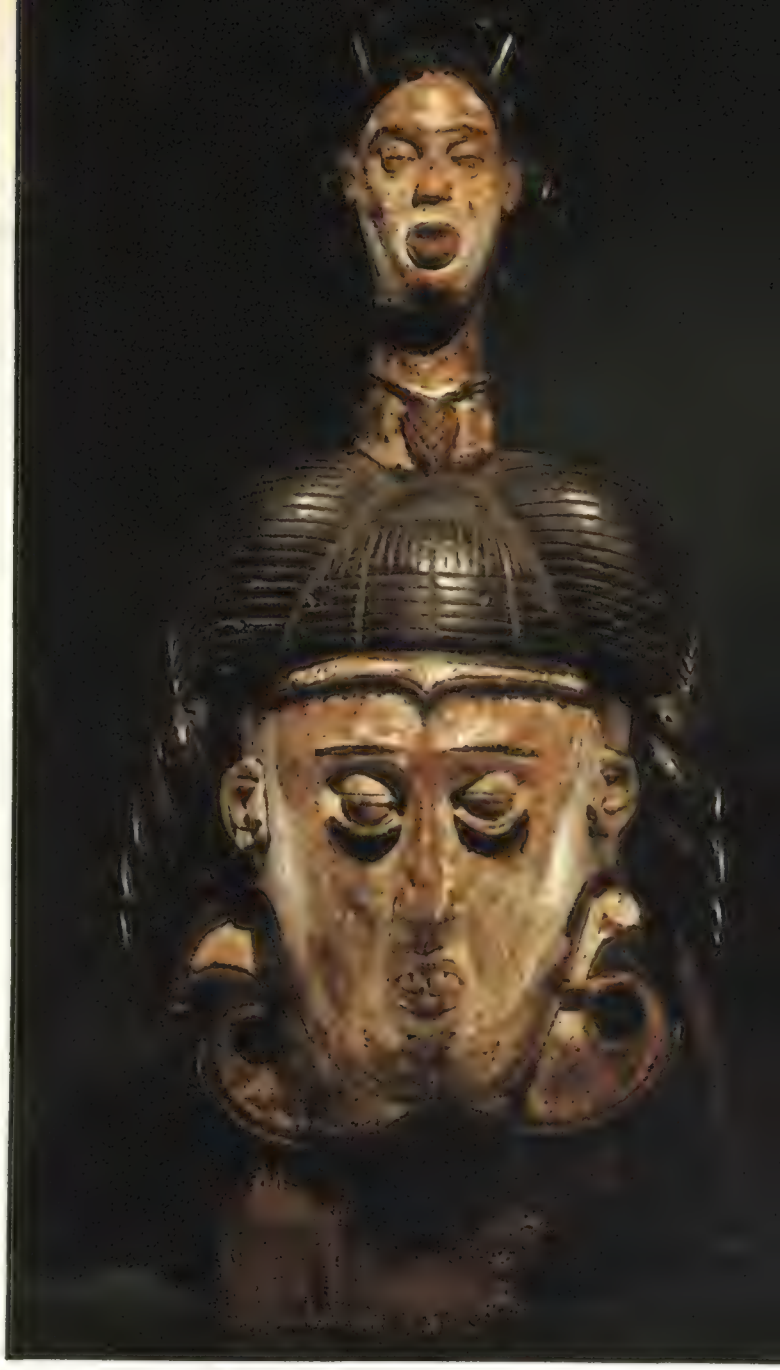
For me, collecting modern art and primitive art at the same time seemed completely natural. I did both with great enthusiasm and excitement. I shared that enthusiasm with René d'Harnoncourt. He and I collected primitive art together for more than 30 years in one of the happiest and most rewarding endeavors of my life.

When I was appointed Coordinator of Inter-American Affairs by President Roosevelt in 1940, I persuaded René to head the inter-American arts program. After returning to New York in 1946, and again becoming president of the Museum of Modern Art, I asked René to rejoin me, first as secretary of the Coordinating Committee of the museum, and later as director.

By the early 1950s, my collection of primitive art had grown to such proportions that we finally decided to create a museum of primitive art. We converted a building on 54th Street across from the Museum of Modern Art for this purpose. The Museum of Primitive Art was opened in the spring of 1957—the first institution totally devoted to primitive art.

A bizarre mask, 25 inches wide, from Mabuiag Island in the Torres Strait, Papua, New Guinea. Center is a turtle shell and a frigate bird perches on top. Few others like it exist and its use is unknown.

Both elegant and whimsical, unusual object is a Dan tribe ceremonial spoon, from Liberia. Of wood, 18¼ inches in length, it is of type owned by wives of dignitaries for use at special feasts.



A mask of painted wood, 22⅜ inches high, is from the Ibibio tribe, Nigeria. Masks such as this are used in rites by members of the Ekkpe Society, concerned with ancestors revisiting the world.

Because of limitations of space, we could show only about ten percent of the collection. Therefore, it was decided that a series of carefully selected and beautifully installed small exhibitions would be held under René's direction. The exhibitions were wide-ranging: for example, "Sculpture from the Pacific" in 1962; "Art of Empire: The Inca of Peru" in 1963-64; "African Sculpture from the Museum's Collection" in 1966; and "North American Indian Paintings" in 1967.

They were accompanied by publications written primarily by two brilliant and sensitive authorities in the field, Dr. Robert Goldwater, director of the Museum, and Douglas Newton, the curator, who became director in 1974.

Over the years from 1957 to 1975, other collectors made important contributions to the Museum of Primitive Art. Among them was my son Michael, who had a tremendous interest in art and who became active as a trustee of the Museum of Primitive Art in 1959. His collection of Oceanic art, formed in the early

Headdress ornament, 7¼ inches high, painted wood with shell inlays, late 19th century, from Alaska or British Columbia. Hawk with human features holds otter between claws.

Sixties, remains a significant feature of the Museum.

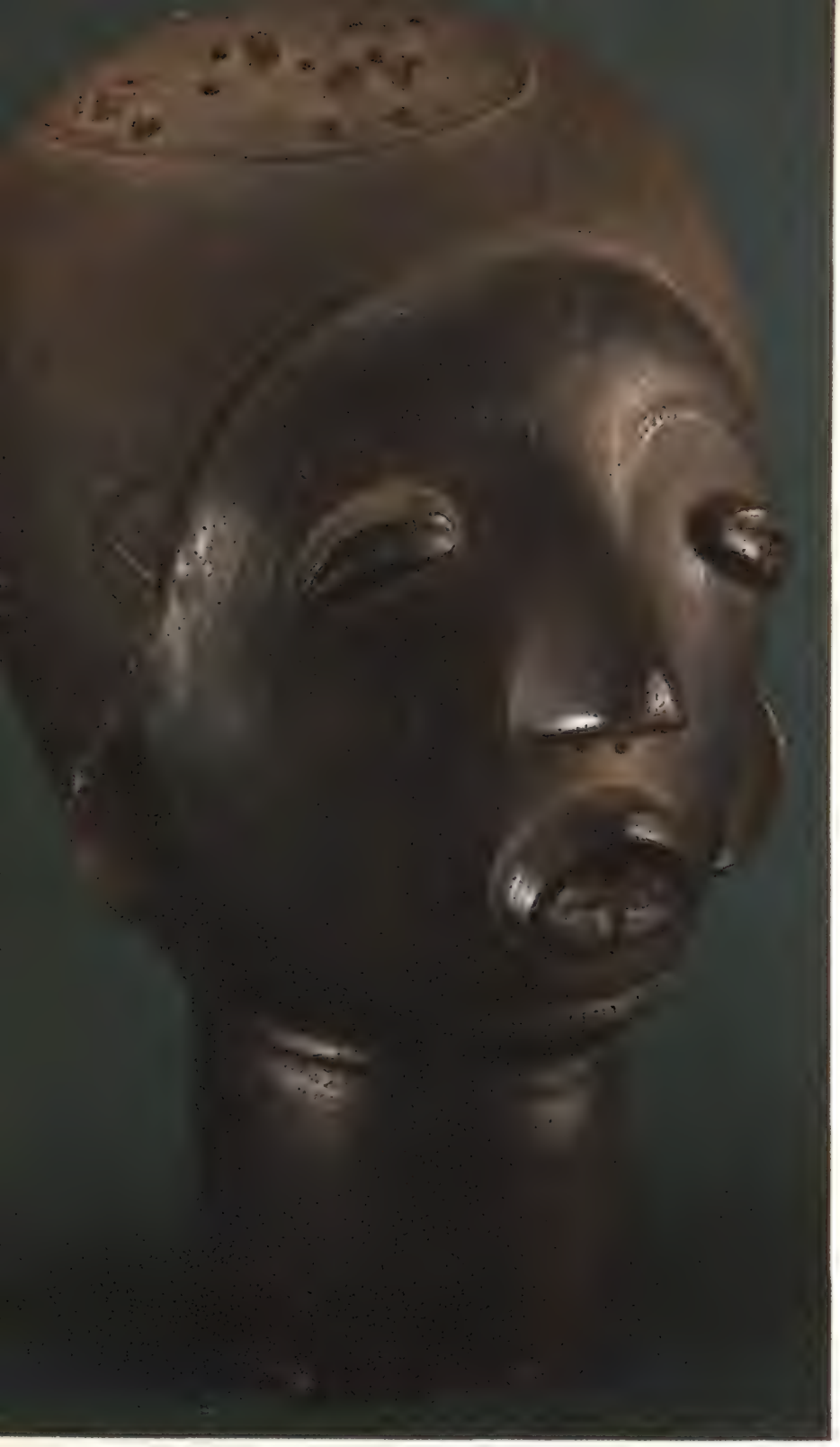
For the first time, primitive art had a home of its own, and by the late 1960s and early 1970s it had come to be accepted by the critics and the public. *Art News* for January 1968 put it this way: "The Museum of Primitive Art was born lucky, but it has had the brains to push its luck, becoming in the dozen years since its founding one of the few museums to combine a passion for the past with a modern philosophy."

But René and I were increasingly concerned by the fact that primitive art was still not recognized by the classical art museums of the country as deserving a place in the history of the world's great art.

We were particularly interested in the Metropolitan Museum, for it was a major standard-setter in the art world. We felt, as we had for a long time, that it was absolutely vital that the Met include the whole range of primitive art in its collection, and thus give the arts of the African, American and Oceanic civilizations recognition in the world's panorama of art.

In the late Sixties, René came up with the idea that

Helmet mask of a female, 41¾ inches high, of wood, Senufo tribe, Ivory Coast. Known as *deble* masks, they are made in male-female pairs and are used usually at funerary ceremonies.



A highly sophisticated head of baked clay, 12 inches in height, made by Ashanti tribe of Ghana. Used as grave markers, such ceramic heads are also decorative, as shown above.

if we could persuade officials of the Metropolitan to put on a major exhibit of the entire collection of the Museum of Primitive Art, it would have tremendous impact and perhaps change their attitude. Finally, the Metropolitan Museum agreed to a show in 1969. Tragically, René never lived to see the realization of our dream, for he was hit and killed by a car earlier that year while bird watching off a country road on Long Island. His installation of the show at the Met would have been a fitting culmination to our 30 years of devotion. But his distinguished protégé, Douglas Newton, had learned from René over the years, and he outdid himself in the installation at the Metropolitan—the first time this collection of primitive art had been shown as a whole.

Two weeks before the show opened, Mrs. Brooke Astor, one of the most creative and imaginative people in New York City and a trustee of the Met, told me she had seen the exhibition and felt that the collection simply had to stay at the Met permanently. There was to be a big dinner before the opening, and she said that if I would be willing to give the collection to the Met, it could be announced that night—and it would be sensational. Her idea was that there should be a special wing built to house the collection; she offered to contribute toward its construction.

It was too good to be true! Here, 30 years after Bill Harkness and I had tried to get the museum into the field of pre-Columbian art, one of its most prestigious trustees was actually suggesting that they accept, on a par with art of all the other great civilizations of the world, the long-neglected creative work of the so-called primitive artists of Africa, the Americas and the islands of the Pacific.

[In his foreword to this book, written in 1974, just two years before his death, André Malraux wrote: "Primitive sculptures were once banned from the museum; now they enter it. Not only because they are the sculptures of half the earth, and of much more than half of time, but also because beyond the frontier figures of Sumer and Mexico, this crucial and ageless art, so strangely relevant to our own, is the art of our next investigation: the night side of man."]

A formal agreement was signed in the next ten days —a record for intermuseum cooperation. Thus René's and my goal became a reality even before the exhibition opened on May 10, 1969. The agreement provides that the collection is to be housed in a new wing of the Met, named in memory of my son Michael. The fact that Michael's lifework would thus be memorialized was a poignant source of additional gratification from this endeavor.

Now the great works of primitive art will be available side by side with the best creative work of Egyptian, Near Eastern, Greek, Roman, Asian, European, American and modern artists.

I have spent my life collecting art of a great many civilizations. It has given me infinite pleasure, opened my eyes and deepened my understanding of humanity. It has been an enriching experience and a balance to the pressures of business and politics—a constant source of spiritual refreshment and strength. It is a privilege to share the joy of this collection.

Gold-weight fish, 3¼ inches high, Ashanti tribe, Ghana. Of brass, gold-weights are utilitarian in purpose, but are also highly inventive artful objects representing people, animals, scenes.

By James S. Trefil

Wood stoves glow warmly again in millions of homes

Man's oldest fuel already supplies Americans with as much energy as do hydroelectric or nuclear plants, and could provide much more

Former Interior Secretary Stewart Udall carries log to his Virginia home, heated almost entirely by wood.

The United States has one energy resource that is renewable and largely nonpolluting; it contributes as much energy to the American economy as does nuclear power and has been used in one form or another by almost everyone.

The resource is wood, a source of energy so obvious that it almost never appears in discussions of alternate technology. Yet our country was built with wood, and the forests with which North America is so richly endowed have not yet made their last contribution to our welfare.

Most Americans think of forests as a national resource. Wood, after all, supplies most of our building materials, our paper and our furniture. The idea that these same forests can make a significant contribution to our energy budget is one that has started to gain strength only within the last few years (or more accurately, to reappear). Our rediscovery of wood, like so many of our new ways of looking at energy, was accelerated by the Arab oil embargo of 1973. Individuals began dusting off grandpa's wood stove or went out and bought a modern version to heat their homes. Businessmen, mainly in the forest products industries, began to increase their use of "waste" (bark and sawdust) to provide heat for buildings and production processes and for generating electricity. The brutal cold and soaring fuel and utility costs during the past two winters have intensified this trend.

In the 1970 census, about one million households (of a total of about 70 million) stated that wood was their primary source of heat. To find out what has been happening since, I asked several wood-stove manufacturers about sales during the last few years. Typical was the response of Riteway Manufacturing of Harrisonburg, Virginia. From 1974 through 1977, sales increased by a factor of 16. Backlogs of several months were not uncommon during last winter's cold. Most estimates now place the number of new wood stoves being added to the nation's supply at a little less than a million a year. This means that there are now probably four to five million homes in the country equipped to derive all or part of their heat from wood.

On the commercial side, one of our largest uses of energy is papermaking (it takes a lot of heat to produce paper). Roughly 2.5 percent of all the energy used in the United States is used in this process. About half this energy is now produced by burning wood waste. Industry spokesmen estimate the same amount of waste is used in drying lumber and plywood.

Thus, perhaps surprisingly, wood is already a major source of residential and industrial energy, ranking with hydroelectric and nuclear power. And compared to "alternate" technologies like solar and wind power, which are just getting started, wood is way ahead.

This parlor stove, once the last word in elegance, dates from about 1900. Many modern wood stoves work exactly the same way, but control the draft better.

Wood stoves make a comeback

This Franklin-type stove, built in 1886, is still going strong in Sag Harbor, New York. Flames are volatile gases burning, not the wood itself.

When we talk about wood as an energy resource, we are really talking about it as a fuel that can be burned to produce heat. In this respect wood is no different from oil or coal (even a nuclear reactor is simply a more exotic way to produce heat). But the process by which wood burns is somewhat complicated, a fact that presents both problems and opportunities.

In the tree, wood may be up to half water by weight. When it is cut the water runs out and the wood shrinks. But even wood that is dry to the touch can contain up to 20 percent water by weight, just because it is exposed to the air. When wood starts to burn, then, the first thing that happens is that this water is boiled off. You may have seen a campfire log steaming just after it was thrown on the coals, or seen the tiny explosions caused by trapped water vaporizing. During this first stage the log actually absorbs heat from the fire while contributing nothing. This is why wood-heating manuals specify that dry wood should be used.

In the next stage, after most of the water has been boiled off, volatile chemicals begin to evaporate from the wood. Beginning with turpentine and alcohol, the list of chemicals that can be "distilled" from wood by heating can run to three or four pages, so the chemistry involved can be complicated. To someone watching a fire, however, it is easy to recognize this phase. If the temperature of the fire is high enough, the volatiles will start to burn as they leave the wood, and this provides the flames.

When all the volatiles have burned, the third and final phase begins. The black material remaining is wood charcoal, and it is essentially pure carbon. Because the volatile chemicals are gone, it will burn without a flame, which is why charcoal is so popular for backyard barbecues. A fire has entered this stage if it consists of a bed of glowing coals that give off a great deal of heat with little or no flame.

Now, although I have divided the burning process into three neat phases, a real fire will not always be classifiable. The log you just threw on may still be steaming while one that has been there for an hour may be a glowing coal.

Another seemingly simple categorization concerns the type of wood which is being burned. There is tremendous folklore about different types of wood and the kinds of fire associated with them. Larry Gay, in his *The Complete Book of Heating with Wood,* quotes an old English verse on the subject:

Birch and fir logs burn too fast
Blaze up bright and do not last
Oaken logs, if dry and old
Will keep away the winter's cold
Elmwood burns like churchyard mold
E'en the very flames are cold
But ash green or ash brown
Is fit for queen with golden crown

Firewood usually is classified as "hardwood" or "softwood." This division has nothing to do with the hardness of the wood, but with its density. Softwoods tend to be less dense, and therefore have a lower overall energy content than hardwoods of the same volume. Softwoods also contain more volatiles, so they burn with more flame. A simple rule is that evergreens are softwoods and deciduous trees are hardwoods.

The author, a physicist at the University of Virginia who has explored the subatomic world for SMITHSONIAN, *heats his house with wood.*

Having said this, however, it is important to explode one of the most prevalent myths about firewood: that different woods have different energy contents. This myth got started because it was (and is) customary to sell wood by volume. A cord, the most common unit, is a stack four feet by four feet by eight feet, regardless of weight. Now a cord of a light wood like pine will naturally weigh less than a cord of a heavy wood like oak. (Similarly, a half-gallon of cheap ice cream, with lots of air in it, will weigh less than a half-gallon of more expensive ice cream.) The two cords actually represent different amounts of wood.

Once we have wood, we need a place to burn it. Fireplaces supplied Europe and North America with virtually all their heat until early in the 19th century, and are still installed in modern homes for their esthetic, if not utilitarian, value. The fireplace as a source of heat, however, presents two major problems. One has to do with the relative lack of control one has over the fire, and the other with the relative inefficiency with which heat is transferred to the room.

A wood fire needs fuel and oxygen to keep burning. You can feed greater or lesser quantities of wood but once the wood is in place it will burn at its own rate. The fire in a fireplace, by heating air and sending it up the chimney, draws in fresh oxygen to keep itself going. If a fire is to be controlled, then, some way has to be found to keep the outside air away from it. The obvious solution is to put the fire into a box of some kind, and put some sort of gadget on it (for example, a movable grate or damper) to block the flow of air when necessary.

What I have described, of course, is the common metal wood stove. In the United States the clearing of forests around large cities like Philadelphia caused people to become more conscious of the efficiency with which they used wood, and led ultimately to the development of the Franklin stove. You might call this familiar device a technological response to America's first energy crisis. It is doubtful, however, whether any of the early stoves really controlled the inflow of oxygen completely. Even with the draft turned all the way down, enough air could usually leak in around the door and at the joints to keep the fire going at a reasonable rate. This meant that if a stove was loaded with wood at bedtime, the fire would go out at two in the morning, and the owner was faced with the unwelcome choice of either getting up in the middle of the night to feed the stove, or waking up to a cold house.

Actually, the major 20th-century contribution to the stove has been the development of techniques for mass manufacturing stoves that *really* control airflow. The term airtight is used to describe these stoves, but controlled-draft is probably a better term. With a modern stove it is possible to put in a load of wood, shut down the draft, and keep the logs smoldering for 12 to 24 hours. This means that the fires will keep going overnight(something that could never be done in a fireplace) and can be brought to a full roar in the morning by opening the draft and letting the air in.

Any of these three logs will deliver the same amount of heat as electric heater held by author delivers in an hour. From left to right: locust, maple, pine.

Getting the heat out

So the modern controlled-draft wood stove does indeed deal with the problem that we have with a fireplace. Does it do anything for the efficiency with which heat is transferred to the room? Let's go back to the fireplace and see how heat gets from the fire to the room under normal circumstances.

When any object is hot, be it a burning log or a piece of metal, it will radiate energy. Sometimes this radiation is visible (we speak of something as being "red hot"), but it does not have to be. When you hold your hand toward a fire you can feel warmth, and the energy which causes this feeling moved from the fire to your hand in the form of radiation. In the fireplace, all of the energy from the fire that gets into the room is transferred by radiation, but because the fire is surrounded on three sides by masonry, this isn't a particularly efficient process. Most estimates say that only about ten percent of the wood's heat gets into the room, and 90 percent goes up the chimney.

A stove, however, usually sits out in the middle of the room so that it radiates in all directions. This in itself is an improvement over the fireplace. In addition, having the stove in the room brings into play another method of transferring heat. Air near the stove is heated and rises to the ceiling, drawing cooler air into contact with the stove, a process called convec-

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The .75 carat diamond shown is enlarged for detail. De Beers.

Coffeepot over wood fire is a classic image. But modern stove in same house (right) is sealed more tightly for greater control over fire. Hot surfaces are covered, so that all the heating is by convection.

tion. Some modern stoves surround the firebox with an outer skin of thin sheet metal, leaving room for the passage of air. Such stoves work entirely by convection; they have the advantage that the outer surface of the stove does not have to be hot for the room to warm up.

Even fireplaces have gotten into the convection act with the development of the so-called circulating fireplace. This is an ordinary fireplace with a hollow metal shell taking the place of the first layer of bricks around the fire. Air from the room circulates around, in back of and over the fire in the shell before reentering the room.

In fact, modern wood-burning equipment comes in such a wide variety of shapes, sizes and designs that the potential buyer tends to be overwhelmed when he starts looking into the market. Those who use wood tend to become emotionally involved, like old car buffs or yachtsmen, and the folklore associated with stoves is endless. In addition, there tends to be a "pecking order," starting with the guy who stores his wood for two years in a shed before putting it into an obscure Transylvanian stove he claims is 90 percent efficient and ending with the suburban fireplace owner who buys his wood by the piece from roving salesmen. Anyone who has lived with wood heat for a year or two is an expert, and the members of the fraternity tend to be opinionated, obstinate and set in their views. (In fact, the only ones I have met who aren't like this are that small minority whose powers of keen observation are coupled to sound scientific thinking and who therefore, naturally, have come to the same conclusions that I have.)

In an effort to separate the facts from the myths, and perhaps to bring my own set of prejudices more in line with the facts, I talked to a pioneer in modern research on wood stoves, Professor Jay Shelton of Williams College. Shelton is author of *The Woodburner's Encyclopedia,* and for the past several years he has been investigating the properties of wood stoves, financing his studies with royalties from his book and by giving public lectures.

His results have tended to disprove some of the folklore. All the stoves he tested had efficiencies between 40 and 65 percent and he found that stove design actually is not the most important factor. It turns out that the single most important factor is the way the stove is operated. If you shut the draft down to keep a fire overnight, you will have low efficiency no matter how the stove is designed.

For the potential buyer, it is probably better to give more weight to personal life-style and esthetics (could you live with this thing in your living room?) than to worry about efficiency. For example, being able to watch the fire may be important to some people and totally unimportant to others. I get a certain amount of ribbing about my circulating fireplace from friends who own wood stoves, for example, but I just tell them that the next cold winter night while they are watching their stoves be efficient, I will put my feet up on the hearth, watch the flames, and toast a marshmallow in their honor.

One concern about wood heat is the environmental effect. Do we really have enough wood to keep us going for a long time, or will we be like the Turks who de-

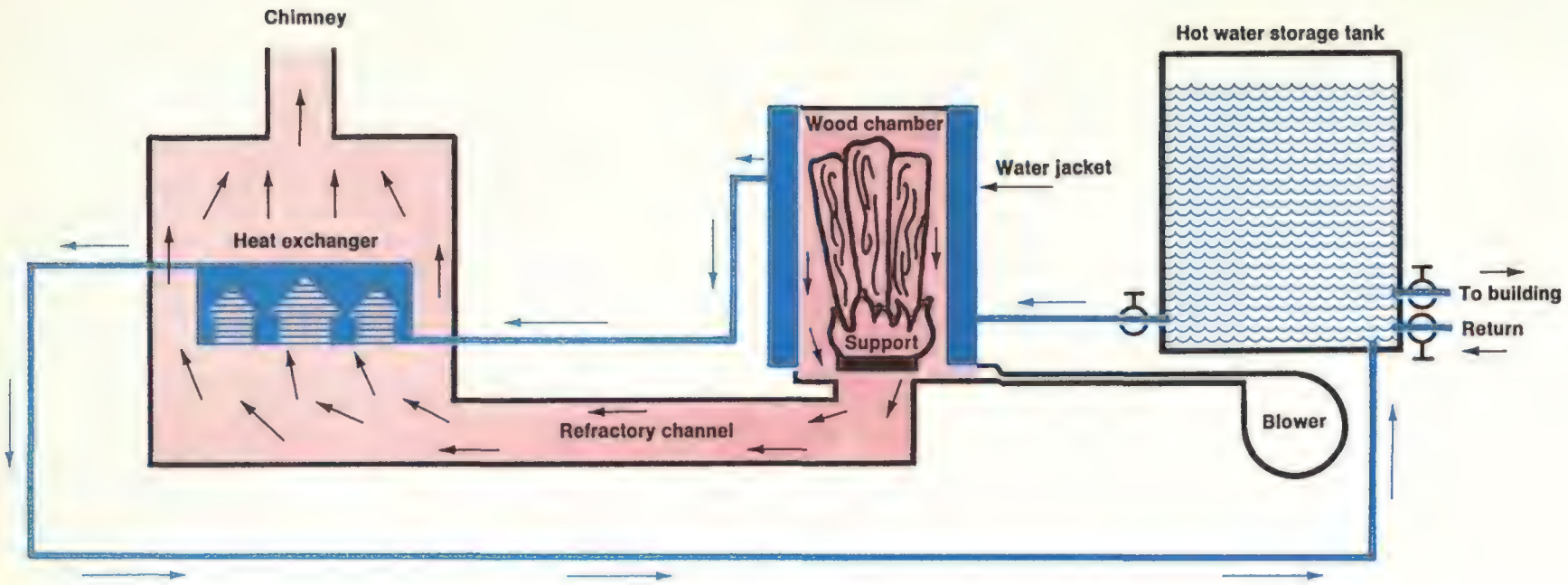

Diagram shows how wood fire heats water twice in experimental setup at University of Maine in Orono. Wood burns in chamber, heating water in jacket; gases continue burning in the refractory channel and heat water again in radiatorlike heat exchanger. Heat is stored in 500-gallon tank until needed, and fewer combustibles and pollutants are lost up chimney. The project is funded by the Department of Energy.

stroyed the forests in much of the Middle East? (Even today large areas of the world are being stripped for firewood, leading to disastrous erosion.) And if we burn wood, what about atmospheric pollution?

To find out about the extent of our forest resource, I talked to Ronald G. Bruner of the American Forest Institute. The U.S. Forest Service reckons that there are 500 million acres of commercial forest in the United States. But Ron pointed out that all of this land isn't commercially productive. Of the 500 million acres, only about 200-250 million are actually in commercial use. This means that there is about one acre of woods for each American.

Forests, once cut, can be replanted or regrown and cut again in 20 to 60 years time. Trees are no different from the tomatoes in your garden: they just take longer to grow. In addition, wood as an energy source need not necessarily compete with the taking of trees for lumber. The wide use of wood scrap for industrial heating we discussed earlier is an example of how these two uses of wood, taken together, simply give a more complete utilization of the forest.

Furthermore, professional foresters have long recognized that if a stand of timber is thinned periodically, and if poorly shaped or otherwise undesirable trees are removed, the remaining trees will grow faster and be stronger than if the stand were left alone. This process is called culling. Landowners have not done a lot of culling, simply because the expense has been greater than benefits derived. If the culled trees have a use as an energy source, however, this trend may be reversed. Some small timber owners in the Northeast have been marking trees to be culled and then selling them "on the stump" to firewood dealers and individuals.

Finally, lumbermen and wood burners want different trees, and even when they want the same tree, they want different parts. The most desirable trees from the commercial point of view are softwoods like Douglas fir, whereas hardwoods are the most desirable fuel wood. In addition, saw timber is taken from the trunk of a tree: the bigger the trunk, the better the logger likes it. Wood for a stove, however, is much easier to handle if it is small, so the top of the tree and the branches are best for this purpose. These tops and branches are usually just left in the forest by lumbering operations.

But what about pollution? What would midtown Manhattan be like if every office were equipped with a wood stove? And what about the greenhouse effect?

The greenhouse effect is probably the most serious long-term pollution problem that we face. When any hydrocarbon, such as wood, oil, natural gas or coal, is burned, carbon dioxide is produced as one of the end products. It enters the atmosphere and reflects heat back to Earth that would normally be radiated out into space, much as the glass roof of a greenhouse traps heat. Meteorologists worry that large-scale coal burning, even with "ordinary" pollutants removed from the smoke, will eventually result in drastic changes in the Earth's weather.

At first glance, it would appear that wood burning would only make this situation worse. It, too, creates carbon dioxide in the atmosphere. But there is a major difference. If coal is not taken from the ground it can-

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not contribute to the greenhouse effect. If a tree in a forest is not burned, however, it will eventually die and decompose. When it does so, the chemical processes involved convert the carbon in the tree into carbon dioxide, just as they would if the tree had been burned. Therefore, every growing tree will eventually return its carbon to the atmosphere, whether we burn it or not.

When we start to ask about more conventional types of air pollution, however, the picture is not so clear. Some of the volatile substances released in the burning process will surely enter the atmosphere. But what they are and what the health problems associated with them might be are simply not known.

Having said this, however, I must point out that wood burning (except, perhaps, in major urban areas) will not be an environmental disaster. When coal is burned, the main environmental problem is associated with the rather high levels of sulfur found in it. Wood contains much less sulfur than does coal. And at least some of the volatile compounds given off in burning are also given off in decomposition, and the arguments we made about the greenhouse effect would apply here as well. After all, the haze from which the Great Smoky Mountains get their name is at least partially due to the products of decomposition.

Finally, the sheer bulkiness of wood as a fuel makes it unlikely that it will ever be used extensively in areas of high population density. If everyone in a high-rise apartment building had a stove, where in the world could they stack the wood? Logistics seem to decree that wood will be used primarily in the two-thirds of our dwellings that lie outside the central cities.

My guess, then, is that wood energy will be somewhere intermediate on the scale of environmental impact. Not as dirty as coal or as dangerous as nuclear, but not as clean as wind or solar.

The real questions about wood heating often come down to decisions by individuals and industries as to whether they are willing to make the accommodations necessary to use this energy source. Let me close with a personal experience that bears on this question. On the day that I returned home from discussing this article with editors of SMITHSONIAN, central Virginia was in the grip of a severe ice storm. Power was out in wide areas, and it was cold. When I got home I brought in an armload of seasoned locust logs my son and I had split the previous fall and, while everywhere around us people were discovering that even gas and oil furnaces will not function without electricity, we lit up the fireplace and roasted hot dogs for dinner. That night we "camped out" on the floor, and while I watched the orange reflections on the ceiling I realized how important it is to have the ability to cope independently with breakdowns in our high technology systems, and how satisfactorily wood heat allows one to do this.

Sometimes, my friends, the old ways *are* best.

Sophisticated video monitor and control panel, above, operate boilers at Chesapeake Corporation paper plant in Virginia. But the fuel, right, is "waste" bark and sawdust left over from papermaking process.

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Michael H. Robinson

Wondrous ways and means of tropical spiders

These eight-legged creatures survive by virtue of a wide variety of behavior—some of it is downright astonishing

In April 1832 H.M.S. *Beagle* sailed into Rio de Janeiro carrying Charles Darwin to his first encounter with the tropics, an experience that would eventually make scientifically acceptable the theory of natural selection. One phenomenon he noticed right off was that "the number of spiders, in proportion to other insects, is here, compared with England, very much larger; perhaps more so than with any other division of the articulate animals." He was mistaken to imply that spiders are insects, but their abundance and variety strike anyone visiting the tropics for the first time, and they undoubtedly play a critical role in tropical ecology.

If a spider is not a "bug," meaning an insect, what is it? (See SMITHSONIAN, August 1971.) All spiders have eight legs and two major body parts—a cephalothorax and abdomen—whereas adult insects have six legs and three body parts. All spiders make and deploy silk, usually but not always in webs, and are ingenious artisans of traps and diabolic lures, their hunting techniques exceeding in diversity those of any comparable group of creatures. All are carnivores (a few steal their meals from other species but most are predators) and suctorial feeders; that is, they generally do not chew up and swallow bites of solid food but inject their prey with digestive enzymes and then suck up the nutrient broth.

The tropical araneologist, as a spider student is called, is never bored with his studies. If he ventures

Tiny jumping spider of genus *Phidippus* (enlarged 40 times) is from the United States, but has many

tropical relatives. Eight eyes—four in front of the head, two on top, two on sides—help it to hunt.

out at night with a flashlight into the jungle, he will see thousands of coruscant spider eyes—mainly those of lycocids, or wolf spiders—reflecting back at him from every leaf and twig in subtle shades of a spectrum of colors. Underfoot, velvety "tarantulas" lurk, monitoring every relevant movement, waiting for a hapless victim to pass by. Tarantulas (p. 72) tend to be large and their size makes them a good food resource for a variety of mammals. Coatimundis dig them out of their burrows and trees and eat them with apparent relish, but these spiders have evolved defenses—some species, for example, bear poisonous barbed hairs which embed themselves in an assailant, causing itching and inflammation.

In daytime, a salticid, or jumping spider (left), will every now and then leap onto its prey and dispatch it with hypodermic fangs. Most spiders use vibration receptors to locate prey, but the salticids hunt almost exclusively by sight. These spiders have two prominent, circular and shining eyes and six smaller ones capable of covering a huge field of vision; in fact, the eyes may together detect movement over almost 360 degrees. They stalk their prey but make the final capture movement in a superbly aimed and precisely judged aerial leap. I recently learned that a tiny Panamanian salticid is able to catch much larger web-building spiders as they repose in their webs! The salticid may jump as much as six inches through the air to land on what, from its point of view, is a dangerous beast in the middle of an intricate and sticky trap. It has the built-in ballistic information to perform this feat with a high probability of success.

Many other spiders just sit tight in one place for a long time, waiting for prey to happen along. One group, the crab spiders or thomisids, frequently hides in flowers where they capture visiting bees, flies and other insects. Like the chameleon, they are able to alter their color to match the pigmentation of the flowers they sit on, and it has been widely assumed that this camouflage works against both prey and predators. However, recent studies have shown that the pattern of ultraviolet reflectivity in the spider does not match the flower's. Since many insects, particularly bees, see in the ultraviolet, the color camouflage of thomisids must be directed at their own enemies.

One Central American thomisid has gone beyond the stage of simple camouflage and has become a

Dr. Robinson is a behavioral scientist associated since 1966 with the Smithsonian Tropical Research Institute in Panama. Color photographs by Smithsonian's Kjell Sandved, N.D.E. Smythe and the author.

flower-mimic in both form and color. This species, *Epicadus heterogaster* (right), is found on the upper surface of leaves in sunny, exposed positions. It folds all the legs tightly against the side of its cephalothorax when it is in the lurking position; otherwise it would give away its identity. The fake-flower ploy should protect the spider against predatory birds, but whether it attracts insects is still unknown.

The webs of spiders reveal almost every principle that subsequently has been developed by Man in the construction of animal traps, ranging from simple trip wires to elaborate spring traps. The wheel-like orb web, with its nonsticky frame and foundation and superimposed sticky trapping silk, has been invented independently by at least three families of spiders. Some spiders cover their silk with a liquid adhesive that ultimately forms viscous droplets, like beads on a string. On the other hand, cribellate spiders work dry threads with special leg combs to produce hackled silk that has a microscopic structure reminiscent of barbed wire.

Orb webs come in all shapes and sizes and may be "operated" at any angle from the vertical to the horizontal. They may be placed close to the ground or strung high up in the crowns of trees. In New Guinea, one species regularly builds an elongate web a few millimeters away from the trunks of large trees. This web is so close to the tree trunk that the spider needs to carry out most of its complicated attack behavior on the outside surface. The spider is even able to bend the web to follow the curvature of the tree and uses stressed elements very much as an inventive aircraft designer would.

Elongate "ladder webs" of superfine mesh that evolved separately, thousands of miles apart, in New Guinea and South America, have been discovered in recent years. They are almost certainly specialized

Camouflaged *Epicadus heterogaster* resembles flower, dines on an insect that has come into its range.

This 20-foot web was erected in Wau, New Guinea, by *Cyrtophora moluccensis,* a species so gregarious that

The nocturnal inch-long *Eriphora fuligenea* builds webs in total darkness. Here it feeds on ensnared bat.

a space the size of a house may hold hundreds of these spiders, each with its own nonviscous orb web.

traps, operated at night in the flight paths of nocturnal moths. These insects are particuarly hard to trap in sticky webs. Their loose wing scales stick to the adhesive and then slip off, enabling them to flutter free. Frequently, a large area of sticky silk becomes powdered with moth scales, rendering the web ineffective. The moth leaves the scene bald, but survives. Ladder webs capitalize on the tendency of insects to fly up or down to escape an obstacle, as flies do on windowpanes. When a moth strikes the elongate ladder web it may initially lose some wing scales and deactivate part of the sticky trap, but as it flutters up or down it encounters additional sticky elements until it runs out of scales entirely and becomes imprisoned.

Spider anglers and gauchos

Once they appeared, orb webs became adapted to a host of specialized prey. One my wife and I studied in New Guinea is constructed by an inconspicuous spider called *Pasilobus* (we don't know the name of the species). This spider builds its web only on very humid nights and slings it between the branches of small trees and bushes. The web consists of a roughly triangular frame, representing one sector of a typical circular orb, and arranged more or less horizontally. Deployed on this frame are a number of sticky threads. These differ from the sticky spiral of a normal orb in that each one is made separately and does not form part of a continuous element; none is stretched tightly between the structural members but each hangs down loosely, well below the plane of the frame. The adhesive droplets on these threads are rather large.

The most important feature of the threads is that one end is securely attached to the frame while the other end is attached only by a low shear joint, which breaks under loads far lighter than those exerted by the spider's normal prey. When an insect flies into the pendant sticky thread the outer end shears and the insect is stuck to a line attached to the web frame at the other end. On this line it plays itself like a hooked fish and may fly round and round, extending the highly elastic thread but staying securely tethered to it. At a certain point the spider rushes over to the attached end of the line, hauls up the prey "hand over hand" and immobilizes it with a clasping bite.

This kind of web could represent a stage through which the bolas-variety of spider passed during its evolutionary specialization. Bolas spiders produce a single thread bearing a huge sticky droplet on the end. This they attach to one leg and, like the Argentine gaucho, spin it around from time to time to catch their prey. My colleague Bill Eberhard has recently shown that a species in Colombia even secretes a chemical that simulates sexual pheromones to which male

Hanging beneath leaf, a slender Brazilian spider and its young share web with cocoa-pollinating flies

moths respond. When the moth gets within range the spider hurls the sticky droplet and then reels in the struggling prey. Of course the thread bearing the gummy ball is never released from the spider's grip so there is really no exact parallel to the operation of a cowboy's bolas.

Another strange development of the orb web is seen in traps constructed by spiders of the genus *Cyrtophora,* which produce typical frames and radii but without a sticky spiral. In New Guinea, one species, *Cyrtophora moluccensis* (pp. 68-69), is so gregarious that several hundred individual webs may fill a space equivalent to a small house. Each web is a domed, fine-mesh structure but completely nonviscous. Above and below the dome is a complex tangle of threads. The spider hangs on the underside of the dome, which acts as a sort of hunting platform through which it can attack prey. Insects fly into the maze of threads above the dome and fall or are shaken onto the platform. The web does not retain prey nearly as well as a sticky orb and it takes much more energy to build. However, the absence of the sticky spiral means that it can be operated for long periods without renewal, whereas most sticky orbs need extensive repair daily. The *Cyrtophora* web exhibits comparatively high capital and low maintenance costs, whereas a conventional orb requires a comparatively small capital investment but continuous maintenance. Climatic conditions probably determine which type is adopted.

Of course, it is not enough merely to build a web; it has to be operated. In the absence of the spider the great majority of insects would break out of even the most efficient orb web. People who enjoy the lithe movements of cats should try watching spiders in action. Many orb weavers attack large and potentially dangerous prey by enswathing them in multistranded silk before biting them.

With collaborators I have studied this trussing in detail, particularly regarding the behavior of *Argiope argentata* in Panama. Only recently I found out that Darwin saw it all in 1832 and his description of the basic process can hardly be bettered: "When any large insect, as a grasshopper or wasp, is caught, the spider, by a dexterous movement, makes it revolve very rapidly, and at the same time emitting a band of threads from its spinners, soon envelops its prey in a case like the cocoon of a silkworm. The spider now examines the powerless victim, and gives the fatal bite on the hinder part of its thorax; then retreating, patiently waits till the poison has taken effect."

Interestingly enough, such spiders also bite and seize some kinds of prey directly. *Argiope argentata* will rush down to a struggling moth, grasp it with powerful jaws, and simultaneously fold long legs around it. The insect is thus imprisoned in a cage of legs and pinioned against the spider while the poison starts to work. There seems to be little doubt that this kind of behavior is more primitive than attack wrapping and is retained in the spider's armory so it can deal with prey of high-escape potential. However, the very intimacy of the bite-clasp means that the spider can't use it against large, powerful or heavily defended prey. The evolution of attack wrapping enabled small spi-

(at right), who use web as sanctuary from predators. Why spiders eat so few of them remains a mystery.

ders to attack larger creatures, and to attack biters, kickers and stingers. Spiders that bite moths but wrap other kinds of insects enjoy a built-in "taxonomic" circuitry; they can distinguish moths from other insects the first time they encounter them.

Living at the hub of the web exposes a spider to predation so it needs a large battery of defenses. One basic defense is simply to jump off the web at the approach of danger; gravity then provides rapid energy-free escape. Since such spiders normally attach themselves to their web on a dragline of silk, they are belayed on this as they fall and can climb back to the web when the coast is clear. Another common defensive mechanism is to shuttle from one side of the web to the other, thereby interposing an extra panoply of silk between the spider and its enemy. For all this, spiders are slain in great numbers, especially by wasps. While filming spiders I have seen them whisked out from under the camera lens by wasps. Once this happened when I was filming a courtship; the male continued courting the empty space on the web where the female had been resting a few moments earlier.

The spider is also exposed to the elements. At low latitudes small animals out in the midday sun can quickly absorb so much heat that their internal temperature rises above a lethal threshold. The web-building spider can either leave its web and move into the shade, thereby sacrificing rapid response to prey, or can place its web in the shade to start with and forego all the potential passersby at breakfast and teatime. Some spiders have optimized the problem by developing a silver coloration which reflects heat. Others simply change position. When sunlight strikes them from the top, they point the apex of their abdomens toward the sun, reducing the area receiving maximum heat to a small cross section of the body. Such "head-standing" postures are adopted by the golden-silk spider, *Nephila clavipes*. If the same species is heated through the web, on its ventral surface, it adopts the complementary posture, one of "tail standing," with the body facing away from the web. Spiders in tropical forests also have evolved special postures to ensure that rain runs off their bodies instead of waterlogging them.

Just as the great mammalian carnivores indirectly provide a living for an array of scavengers, such as hyenas and vultures, so do the web-building spiders. Tiny theridiids, relatives of the black widow, steal from feeding sites or the larder where the host accumulates surplus items. The tactics of theft are astonishingly complex and purposive when you consider that the thief's brain is several orders of magnitude smaller than the most miniaturized integrated-circuit device!

A formidable-looking four-inch-long tarantula rests on a *Heliconia* leaf in Brazil. Dance called the tarantella may duplicate frenetic exercises medieval Europeans once used to cure bites from spiders.

Extraordinary close-up photograph by Smithsonian Institution's Kjell Sandved shows strands of liquid silk extruding from spinnerets of a New Guinea spider. Strands quickly solidify into strong threads.

The theridiid sneaks down to the bulky packet and attaches a silk line to it; the line is then taken to some point off the plane of the web and attached to a firm object. The kleptoparasite next returns to the loot and cuts it free of its moorings. Gravity does the rest; the packaged insect swings safely away from the host web and the theft is a fait accompli. Other forms of thievery are less dramatic from the engineering point of view but demand a stout heart. The kleptoparasite may simply approach a feeding host and sup from the same prey. It can also purloin and stash away items so small that they are ignored by the host. A variety of camp-following flies and even caterpillars also depends upon such leftovers.

One fact everyone supposes is that female spiders eat their mates. As a reformed chauvinist, I am delighted to state that this is by no means a Universal Truth. But the reproductive behavior of spiders is bizarre enough without hyperbole. Sperm transfer in all species is indirect. The organ of transfer is the highly modified male pedipalp, or feeler. Each male has two pedipalps situated on the front of the cephalothorax well away from the genital aperture on the lower abdomen, but outfitted with a storage device from which sperm can be forced down a long needle-like tube. It is this tube, the embolus, that is introduced into the female genital opening, or epigynum, during mating. Before the male starts his courtship he has to load his pedipalps with sperm. In fact, he first produces a small pad of silk called a sperm web, onto which he places a drop of sperm. Having done this, he can reach back with the pedipalps and take up the sperm from a clean surface. In orb weavers, a fully laden male is often clearly distinguishable because the ends of his pedipalps glisten with sperm.

Courtship is usually defined as a process of achieving species compatibility prior to mating. In web-building spiders the main problem is that an approaching male has to signal in some way that he is a member of the female's own species and so exhaust or abort her predatory drive. This is achieved in different ways, depending on the species. Sexual dimorphism may be extreme; in the golden-silk spider, for instance, the male may be a tiny fraction of the adult female's weight. He approaches her across the web in a particular stylized gait that is maximally distinct from the frenzied struggles of a trapped insect. His smaller size probably also reduces the risk, as he is simply outside the range of prey acceptable to all but a starving *Nephila*.

Courtship in this species is simple; it involves repeated approaches to the epigynum and intermittent attempts at copulation. The male descends the ventral surface of the female's abdomen, attached to his dragline like a rock-climber on a mountain wall. When opposite the epigynum, he raps repeatedly on it with his pedipalps until he makes an insertion. Throughout all this, the female appears indifferent. Occasionally a female *Nephila* can be seen brushing at a courting male with her legs, as if she feels an itch or some other pesky nuisance.

I define this simple, direct courtship as primitive; at the other extreme, the male lures the female out of her web to a mating site he has constructed. He attaches a special silk line called a mating thread to the outside of the female's web. At the web end, the thread often is attached to the end of a radius; this radius leads directly down to where the female sits in wait of prey. The outer end is often attached to nearby vegetation. The male spider eventually takes up a position on the mating thread and, by jerking, twitching and strumming, sends vibrations down to the female.

These vibrations usually induce one of two responses: either the female rushes out onto the mating thread as if to attack the male, or she moves out slowly and when on his thread assumes a passive posture with most of her legs off the line. The first kind of response leads to safety measures on the part of the male; the second leads to mating attempts. If the female approaches too brusquely, he can simply cut the mating thread ahead of him and swing safely away, or jump off the mating thread still attached to his dragline. This kind of courtship rarely leads to cannibalism of the male by the female, at least in the tropical species I have studied.

A final example of the complexities of courtship is one that I observed in Natal, South Africa. There, a spider called *Isoxya* courts on a mating thread but with an added touch. If the female is too aggressive the male may break the line and then attach it to his spinnerets. As she runs toward him, he simply pays out more and more silk. All she has to show for her efforts is a ball of silk; I have called this the treadmill effect and it may well serve to exhaust the female's predatory instinct.

Spiders are widely misunderstood, oft-maligned and of course feared creatures, but further study of their ways could pay off in analogues to the much more complex behavior of the higher animals, with implications for Man himself. Spiders are also marvelously efficient beasts, adapted to their environs by more than 300 million years of natural selection, and definite allies of Man in his struggle to keep insect pests at bay. Thus I feel no hesitancy in saying that any friend of a spider is a friend of mine.

Tiny male *Argiope* from Australia approaches a much larger female to begin copulation.

Malaysian *Argiope* female clutches small male to her body so he can impregnate her with his pedipalp.

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While interested spectators watch from perches on wall, summer solstice sunrise pierces through special

By Ray Williamson

Native Americans were continent's first astronomers

New studies of old ruins indicate Indians tracked movement of sun and stars to set agricultural and religious calendars

Craig Benson and I had arranged our gear on the dirt floor of Hovenweep Castle's sandstone tower (p. 81) just in time for the show. In a few moments the sun would set on the distant ridge, and as it set it would send a shaft of light through a narrow opening in the western wall of the castle. It would, that is, if our calculations were correct.

Craig and I were members of a team consisting of an anthropologist (Florence Ellis), an archaeologist (Benson), a physicist (Howard Fisher) and an astronomer (myself). We were here at this ancient ruin in the Utah desert to work in a relatively new scientific discipline—indeed, one new enough that its practitioners have not quite agreed on whether to call themselves archaeoastronomers, astroarchaeologists or ethnoastronomers. What they are attempting to understand and explain is the astronomical knowledge of early civilizations as revealed by their art, architecture and oral traditions.

Astronomy is a very old science. Thousands of years ago the Chinese were charting the sun, moon and stars with great accuracy. The ancient Greeks estimated

port in Casa Rinconada, New Mexico. Structure was used by Indians to determine timing of solstice.

New Mexico sunlight falling on niche opposite port indicates that the summer solstice has arrived.

the circumference of the Earth and the distance to the sun and moon. The Maya developed a calendar that could be used to predict eclipses centuries hence. But now we are learning that the practice of relatively sophisticated astronomy was more widespread than had been realized and, indeed, that native Americans wove scientific knowledge of the heavens into the fabric of their daily lives. Much of the art and the architecture of American Indians of a millennium ago can be better understood in relation to celestial events.

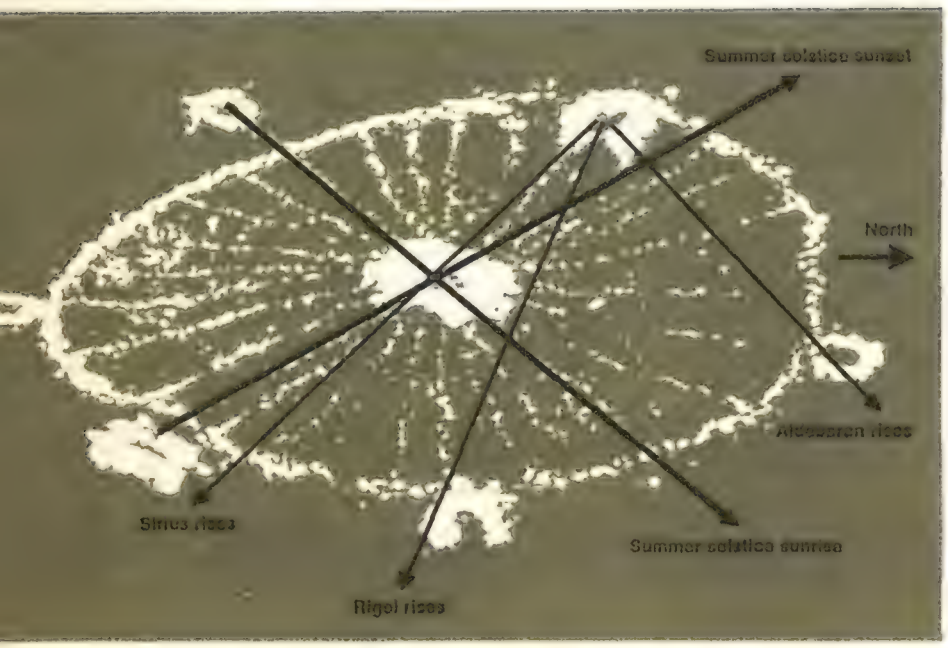
In our own project, sponsored by St. John's College in Annapolis, Maryland, and the National Geographic Society, our aim was to try to determine to what extent certain Indians of the Southwest had incorporated astronomical alignments into their architecture. Over the next 12 months, we were to learn the answer—or at least part of it.

On this particular afternoon at Hovenweep Castle, at the beginning of our studies, we waited with anticipation as the sun dropped closer to the horizon. It was the time of the summer solstice—an event which we believed the builders of this ancient castle had understood. Our measurements and computer analysis had suggested that the narrow port in the sandstone-block wall was so placed that at sunset the last rays of the sun would pierce it, announcing the turning of the year in a way that all could see.

But the computers left unanswered questions. Where would the sunlight strike the wall across from the opening? Would the alignment be exact enough to have been used for calendar observations?

Sooner than we expected, a shaft of sunlight penetrated the aperture. At sunset it fell precisely on the corner where the northern and eastern walls joined. Our earlier guesses had been confirmed—the corners of this old structure were the sighting posts, as it were, for observations of the sun. Hundreds of years before, the inhabitants of the castle had observed the event we had just watched, and had known that the sun's daily path across the sky would now shift slowly toward the south and that the seasons would continue in their endless rotation.

The tower Craig and I were examining is just one of hundreds, both astronomical and ordinary, located



Pairs of cairns in Bighorn Medicine Wheel aim at solstice points, 13th-century positions of key stars.

Located in mountains, the wheel (see above) perhaps warned Indians to begin autumn trek to valleys.

in the area where the states of Arizona, Colorado, New Mexico and Utah meet. Built by the ancestors of the Pueblo people called Anasazi (a Navajo name meaning ancient ones), these towers, some of which may also have been moonwatch stations, were originally two or three stories high and contained a number of rooms. They are either round, square or D-shaped, and usually situated at the very edge of canyons or on huge boulders.

We know that the original "D" tower of Hovenweep Castle was constructed in about A.D. 1200. Several generations later more rooms were added, including the chamber where we observed the solstice sunset. During the construction process, the Anasazi incorporated two special ports, or sighting holes, into the walls, one aligned to the summer solstice sunset on June 21, the other to the winter solstice sunset on December 21. In addition, they designed the outside doorway of the castle so that its jambs align to sunset on the two equinoxes (roughly March 21 and September 21), when day equals night in length. These facts led us to believe that the ancestors of the Pueblo people 700 years ago may have employed a precise calendar for planting, harvesting and ritual observances.

Craig and I repeated our pilgrimage to Hovenweep Castle the following December. This time we were not surprised to see the setting sun's rays fall on the upper corner of the doorway to the original D-shaped tower. But another observation struck us as we inched our way along the ledge after dark. The desert was cold, but updrafts of warm air from the canyon bottom kept the area comfortable. So, in addition to the water source at the head of the canyon, the Anasazi were probably drawn to settle there by the comforts of a solar-heated canyon as well.

How might the alignments have been used to establish a calendar? In the course of its yearly cycle, the sun appears to move north along the horizon from day to day, then slow down, pause and turn around on the day that we call summer solstice. It then moves south to the winter solstice point where it again slows down, pauses and begins its northward journey all over again. The farther north the sunrise or sunset, the longer is the day in the northern hemisphere. The southward pause was of particular concern in most traditional societies because if the sun didn't move northward again, perpetual winter would envelop the Earth. The fields would stay frozen and unsuitable for planting. So, most people devised ceremonies to persuade the sun to return to the north.

Sun watching is still practiced today in various

Ray Williamson is a teacher at St. John's College in Annapolis. A Smithsonian Fellow, he writes often about ancient astronomers.

pueblo communities throughout the Southwest. At the Hopi pueblos, for instance, the times for ceremonies and for planting and harvesting are determined by watching the sun rise and set in relation to the mountain skyline. Each important day has a peak or notch named for it. When the rising or setting sun appears or disappears at the appointed landmark, it is time to perform the ceremony or begin planting. This form of calendar is likely to be a very old one, because the only requirements are a suitable place to stand and obvious horizonal features in the appropriate directions. Thus we expected to find something like it at Hovenweep or nearby Chaco Canyon. High up on the mesa wall at the eastern end of the canyon, our graduate assistant Donnel O'Flynn found a striking sun symbol silently marking such a place (p. 82). A similar ancient sun-watching shrine in Chaco Canyon (somewhere west of our find), suggested some years earlier by Florence Ellis, professor emeritus of the University of New Mexico, also checked out.

A supernova's record in rock?

Of course, it is impossible at present to date any rock art precisely, but both sun-watching locations are in the vicinity of buildings erected between the 11th and 12th centuries, and so the rock art probably dates from that era. It is also worth considering that the Chaco glyphs—including a sun, a crescent moon, a star and a hand—could conceivably represent the unusually spectacular supernova, or stellar explosion, of July 4, 1054. Computer calculations show that shortly after the crescent moon arose in the predawn hours, the supernova appeared to the south of it, shining brighter than Venus. In the pictograph, a ten-pointed star is below the crescent of a waning moon, and the sun is lower, possibly at a presunrise position.

Did the Chaco Canyon Anasazi really commemorate this event? Only further research can tell. Florence Ellis doubts it because there is no tradition in any pueblos today that their ancestors recorded this kind of occurrence, and because the glyphs could just as easily represent positions of the sun, moon and morning star, all major deities in the native pantheon.

As at Hovenweep, the Chaco Anasazi deliberately used architectural features to mark the solstices and equinoxes. But this group, who built with finely quarried sandstone slabs, oriented whole structures to the sky. Probably the most striking example is Casa Rinconada, a so-called great kiva or ceremonial chamber erected in the 11th century A.D. (pp. 78-79). Similar assembly halls are in use in the pueblos today. Anthropologists believe that the great kiva was a gathering place for community-wide religious observances. Casa Rinconada, nearly 20 meters (66 feet) in diameter and

December sunrise silhouettes solstice chamber (left) and ruined tower of Hovenweep Castle, New Mexico.

Researchers gather in solstice chamber at Hovenweep to observe the sunset on the longest day of the year.

Researchers believe that this ancient painting in Chaco Canyon indicated site of a special observatory.

Looking east from site of painting, scientists saw a bleak desert scene with a stone pillar bisecting the horizon (above). At dawn on the winter solstice, the sun rose directly behind this pillar (right).

4 meters (13 feet) deep, is capacious enough to hold several hundred people.

In the historic pueblo of Acoma near Albuquerque, tradition claims that the first kiva was built round because the sky where it meets the Earth is a circle; it was emplaced in the Earth as a symbol of the underworld from which the Pueblo people originally emerged.

We first visited Casa Rinconada at night. As we entered the roofless kiva through the south doorway, we saw the North Star, about which all the other stars appear to revolve, directly above the north doorway. So the kiva's north-south alignment is quite precise. About a meter above a circular bench lining the tower wall, there are 28 regular wall niches, each a cube about 30 centimeters on a side. All but two of these niches form pairs which define lines passing through the kiva's geometrical center. Furthermore, the line between niches 8 and 22 constitutes an exact east-west line. Thus all four cardinal directions are represented. The four floor sockets which held the roof supports form a square whose sides also correspond to the major points of the compass.

Directly across the canyon from Casa Rinconada, a purely ceremonial center, lies Pueblo Bonito. This 800-room high-rise, excavated by Smithsonian archaeologist Neil Judd in the late 1920s, is not only astronomically oriented, but may have been designed to maximize winter absorption of the sun's radiant energy as well. Indeed, a curving north wall and a terrace effect radiate solar energy back to the central plaza, where much of the daily work of the pueblo, such as corn grinding, cooking and tool making, probably went on even in winter.

Other Indian groups throughout the North Ameri-

can continent also built solar and stellar observatories. Among thousands of stone rings situated on the eastern slopes of the Rockies are a few large, complex structures known as medicine wheels. Laid out by the early tribes before the white man appeared in the West, the function of the wheels has long been a mystery and local Indians used to disclaim any knowledge of who built them or what their purpose might be. A widely known one is the Bighorn Medicine Wheel, located on Medicine Mountain in the Bighorn National Forest of northern Wyoming, where the observer has an unobstructed view of the eastern and western horizons (p. 80). Perhaps connected with the Plains Indians' sun dance ceremony, it forms a circle some 25 meters (82 feet) in diameter. From the rim, 28 stone spokes converge on a central cairn; small cairns are placed here and there around the periphery.

From observations made in 1972 and 1973, astronomer John Eddy of the High Altitude Observatory in Boulder, Colorado, discovered that the Bighorn Medicine Wheel is aligned to the sunrise and sunset positions of the summer solstice sun. Since then, he and archaeologists Tom Kehoe of the Milwaukee Public Museum and Alice Kehoe of Marquette University have shown that other medicine wheels as far north as Saskatchewan, Canada, also mark the summer solstice. In addition, the Bighorn and the Moose Mountain Medicine Wheel in southeastern Saskatchewan are aligned to three bright stars—Aldebaran, Rigel and Sirius. Aldebaran makes its first yearly appearance in the eastern sky just before dawn on the solstice. Eddy has surmised from his investigations of the Bighorn site that two of the smaller rock cairns would have told an observer just where to look for

Aldebaran in the few minutes before it was obscured by the rising sun.

Likewise, the stars Rigel and Sirius appeared just before dawn one and two months, respectively, following the summer solstice, and their horizon points were marked by other pairs of cairns. Because the danger of early snow is great in this high-altitude location, Eddy speculates that the Indians who built the wheel would have taken the appearance of Sirius in late August as a sign that they should soon retreat into the valleys. Admittedly, those two stars are not in the same positions they occupied centuries ago. But Eddy calculated that they were aligned correctly for observers between the 12th and 14th centuries A.D., and the dates are consistent with what was previously known of the wheel archaeologically.

Farther to the east, another group of prehistoric native Americans were apparently also reckoning the year by tracking the sun. Archaeologist Warren Wittry has been investigating the remains of four circles of postholes from the tenth-century Indian city of Cahokia, near the Mississippi River just east of St. Louis. It supported an estimated 30,000 people and contained the largest earthen mound north of Mexico, called Monk's Mound.

Wittry showed up at the site to document sunrises during the fall equinox and winter solstice in 1977. Because the original wooden posts had long since disappeared, Wittry put utility poles in the three postholes which mark the equinox and solstice directions and in a hole near the center of the circle, which he surmises was used to support the observation post. Sitting part way up the observation post at the time of the spring or fall equinox, the sun priest of Cahokia would have seen what Wittry and his colleagues saw—the sun rising directly behind the equinox post. Wittry's winter observations confirmed a similar arrangement for the southeast pole which points directly at the winter solstice sunrise.

Wittry is impressed by the exactitude with which the posts are laid out and has expressed the opinion that the ancient Cahokians may have used a basic unit of measurement in constructing the circles which he calls the Cahokia Yard. This suggestion caused controversy in archaeological circles, but use of a unit of measure by indigenous people is conceivable.

The prehistoric native American who has emerged from these studies is a being of high intelligence and keen insights. The precise form of his astronomical instruments varied according to the needs and customs of each group, but it reveals an intense awareness and scrutiny of motions of celestial bodies. Certainly the Indians wanted to assure the success of their crops, but their interest in astronomy reached far beyond purely utilitarian needs. This is especially true for the Plains Indians, who were not farmers. The Bighorn Medicine Wheel, for example, is difficult to reach and it often snows at the site in late June, but it may have been a meeting place for nomadic tribes where sun-related ceremonies were held. Casa Rinconada may have functioned in a similar manner by having served as an assembly point where the local inhabitants could conduct canyon-wide ritual observances on major religious occasions.

Certainly a "cosmic" point of view permeated the thinking of native Americans in historic times. The medicine wheel, the kiva and the observatory are merely artifacts of their struggle to understand the world they inhabited. In that respect, though the settings may seem alien and the technology primitive, the early Americans were distinctly like ourselves.

Pueblo Bonito, seen from north, is aligned to compass points. Old kiva foundations form circles on plaza.

In time exposure taken from south, steady north star hovers above the stairs. Other stars form streaks.

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By Keith Wheeler

Neutron beams, a thinking robot and ultrasound

Research at the Bureau of Standards extends the limits of knowledge by, for instance, measuring cycles in the trillions per second

Earlier this year, the National Bureau of Standards was cited for achievement by another prestigious arbiter of measurement: the *Guinness Book of World Records*. The bureau won this honor for work done at its Boulder, Colorado, campus, where NBS scientists employed a device called a helium-xenon laser to determine the highest frequency ever measured by Man. For those who can read that sort of language, the descriptive numbers were 147.915850 THz, which is to say *that* many million million cycles per second.

The bureau's principal preoccupation remains that of adding digits after the decimal point, steadily reducing the degree of possible error in Man's understanding of the universe. But as the bureau goes about its business of measuring things—and some of the things it measures were undreamed of not many years ago—it finds itself increasingly absorbed in what things *are* and why they do what they do. The more the scientists learn, the more layers of complexity they encounter, and the harder they must strive to turn their findings to the service of mankind.

Thus, while the bureau is engaged in such comprehensible activities as pummeling football helmets and burning up living-room furniture to determine product safety (SMITHSONIAN, September 1978), it is simultaneously marching off toward the scientific horizons.

Its goals are sophisticated—and so are its tools. In Gaithersburg, Maryland, NBS scientists use a fearsome machine called the LINAC (p. 91), one of the largest installations in the bureau's possession, to measure some of the smallest known particles in the universe. LINAC, an acronym for linear electron accelerator, is essentially a vacuum tube one inch in diameter and a hundred feet long. Electrons shoot down this tube riding the crest of an electronic wave like a surfer riding the big breakers off a Hawaiian beach. The electrons are focused by magnets onto the nuclei of atoms. The pattern in which the electrons scatter reveals the size and shape of the nuclei. The scientists employ the big machine on programs as diverse as devising standards for cancer therapy and assembling the data for nuclear power-plant design. An idea of where LINAC gets its muscle may be derived from its electricity bill, which runs about $10,000 a month.

Sometimes a bureau program launched in one direction will yield unexpected dividends in another. In pursuit of their franchise to investigate the properties of materials, NBS scientists experiment with various techniques for what they call "nondestructive testing." This is to say, methods for locating and identifying defects or other variations inside an object without tearing it to bits.

Diagnosis by "seeing" with sound

One technique they work with is ultrasound, sound beyond the capacity of the human ear. The researchers project high-frequency sonic waves into a material and record the frequency, content, timing and nature of echoes that bounce back. Early on, the technique showed significant promise in industrial applications, such as performing periodic integrity checks on the vital cooling systems of nuclear power plants.

Then, in laboratories outside the purview of NBS, it was discovered that ultrasound would work on soft and malleable materials as well as on those as hard and dense as steel. This finding led to speculation on ultrasound's potential as a diagnostic tool in medicine. It was found that a sonic pulse projected into living tissue sets up a distinctive echo whenever it encounters some discontinuity as, for example, an abnormality in an organ. By measuring the nature of the echoes, scientists could locate a suspect region precisely and even determine its character.

About three years ago a group of researchers headed by Dr. Melvin Linzer, chief of a signal processing and imaging project in the bureau's Center for Materials Science, went to work on ultrasound. The product of

Guided by electronic camera mounted on its "wrist," the bureau's robot arm moves to retrieve a piece of a bearing assembly. If the desired object is not within its reach, the arm quits work.

Photographs by Robert C. Lautman

this work, a system called SonoChromoscope (below), is now undergoing clinical evaluation by the National Institutes of Health. The device, still in the process of refinement, suggests important advantages over the most advanced X-ray instruments available today. It is much cheaper to use. And, so far as research has been able to determine, it is absolutely safe.

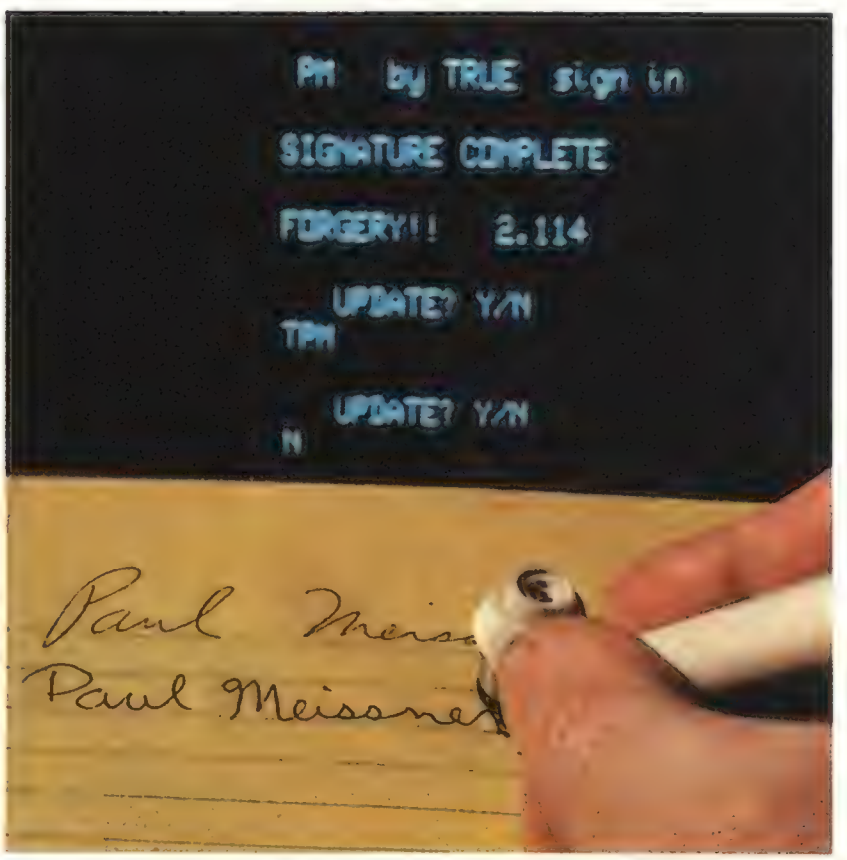
"It permits continuous recording of tissue at work—as in the opening and closing of a heart valve. X ray can't do that," Dr. Linzer points out. "By employing computer technology to convert one kind of signal to another, the technique can be used to produce accurate diagnostic color pictures of a human interior. An echo with a high-frequency content would be transmuted into a spot of blue or one of low frequency into a dot of red, and so on. At its present state of development, the technique is capable of identifying different types of tumors and other abnormalities."

One of the most promising applications Dr. Linzer's group envisions is a method for early detection of breast cancer. At present the most advanced technique in use is X-ray mammography, which is inherently dangerous, especially after repeated exposure. Ultrasound could be certain and safe.

A few years ago Congress asked the bureau to take a hand in working out the parameters of a health problem of staggering proportions. This was monitoring Man's environment and devising tools to measure how much harm was likely to flow from things he was injecting into his surroundings. By now NBS is working with at least nine other government agencies, all the way from the Navy to the National Institutes of Health, to trace and define environmental contaminants and develop standards for measuring them.

The field is immense. One NBS study resulted in production of a unique instrument for measuring even minuscule amounts of ozone in the lower atmosphere. Another has evaluated a mathematical system for tracing the peregrinations of DDT and other pesticides through soil, rivers, lakes and into the food chain

SonoChromoscope is used to examine internal organs. Transducer placed on abdomen sends and receives sound, and equipment at upper left processes echoes.



Bureau tests new signature-verification systems like this one. When someone fails to duplicate genuine signature (top line), the machine flashes: "Forgery!!"

in the flesh of fish. From other studies have come arrays of standard reference materials used in calibrating instruments to determine where and when workers may be overexposed to toxic materials such as beryllium, lead or cadmium. A great deal of work is going on to determine the possible hazards created by microwave radiation.

Since the fundamental job of NBS is metrology—the science of measurement—it follows that its basic tools are numbers. The handiest modern receptacle in which to store a lot of numbers and from which to get them back when needed has proved to be the electronic computer, a fact which NBS appreciates profoundly. It designed and built the first big computer in the United States, completing it in 1950. Today the bureau employs almost 90 of the machines. They work, among other things, at trying hard to improve their own performance.

The bureau's computer research probes into major problem areas: improving communications among computer networks, keeping meddling fingers out of computer data banks, and progressively honing their electronic talents to take on more and more of Man's work and maybe, ultimately, even some semblance of his thought processes. There is no reason, bureau experts say, why a computer cannot be taught to diagnose its own ills and cure itself when ailing.

There may be defensible reasons of tradition, patriotism, habit and upbringing for one man to speak Swahili and another English and for neither to understand the other. But NBS technicians can find no excuse whatever for allowing computers to indulge in similar luxuries of mutual incomprehensibility, and thus they are trying to create a universal computer vocabulary. The overall chore would have been simpler had the early computer makers got together and agreed on a common dictionary of computer symbols, but they didn't. Some computers, for example, use only capital letters, while others use both capital and small letters. With this language bar between them, two otherwise compatible computers can speak only Greek to one another.

NBS computer experts have been making progress both in getting standards for common computer languages and devising common computer codes for calendar dates and geographical places. During the past five years, the bureau's computer scientists have worked out simplified letter and number codes for every state, county, township, city, and 136,555 individual places as small as hamlets and even crossroads, as well as 225 foreign countries. Such codes are of particular value to bodies like the postal and customs services, banks, insurance companies and commercial shippers. As an exercise in computer adaptability, they have even worked up a syntax for encoding Nevada cattle brands.

With the proliferation of computers, the integrity of individual systems and of interlocked computer

An engineer monitors electron beam of the bureau's 100-foot-long linear accelerator in Gaithersburg. At left is red focusing magnet, used to help control the beam. Experiments performed with the accelerator will help the bureau's scientists in establishing new safety standards for nuclear-power installations.

In research aimed at assisting the integrated-circuit industry, the bureau makes its own circuits in a dust-free "clean room." Above, technician prepares silicon wafer to be imprinted with circuit design. After imprinting, the circuit is completed by baking at 1,100 degrees C in special furnace (opposite).

networks has become as imperative as the time lock on the vault door at Fort Knox. For one monstrous example, a meddler plugged into the Social Security network, which eventually will have 2,000 computers hooked to its Baltimore nerve center, could hopelessly scramble the records of 140 million workers. And there is the vital issue of the right to privacy and the danger of its being invaded by someone with access to data banks of individual medical or credit records. With the rapid increase of electronic banking in recent years, computer fraud has become a baffling new kind of crime. In a recent case $1.8 million was ripped off by bandits tampering with an electronic transfer-of-funds system between a bank in California and one in New York.

Working with private industry, the bureau's computer scientists are developing techniques to foil marauders. One requires a potential user to sign in with an electronic pen while the computer reads the dynamic characteristics of the signature, such as speed and pressure (p. 90). If the computer doesn't recognize the name or dislikes the way the user scrawls his moniker, a red light comes on to indicate nothing doing. Another technique is based upon the computer's recognition of the user's voice, a system possibly vulnerable to a skilled impersonator. A third, the most complex, depends on encryption—writing computer talk in a secret language—which cannot be decoded without possession of the correct 16-decimal-digit key. Since the key is capable of 72 quadrillion variations, the chances of a raider having the right one at hand are slim indeed.

Computer theorists and technicians find it impossible to resist the challenge implicit in the fact that computers are already a lot smarter or at least more efficient than human beings at certain functions. So why not at even higher functions?

Early generations of computers were the opposites of human infants when it came to capacity and methods of learning. Children begin learning by *looking* at things: people, animals, pictures. The formal stuff, words and numbers, comes later. By contrast, computers were brought forth both sophisticated and ignorant; they were ready to recognize and deal with numbers and letters but pictures were incomprehensible to them.

As the bureau's head of artificial-intelligence research in the National Engineering Laboratory, Russell Kirsch has spent the past two decades teaching computers about pictures and how to make judgments about them. This is called "image pattern recognition," and it means that a well-instructed computer can look at irregular and varied images and make decisions concerning them. Over the years the technique has come to have practical applications in such

different fields as medicine and the monitoring of natural resources with satellites.

Now Kirsch is working to assign his educated machines an important role in paper manufacture. Quality control in papermaking depends on continuous monitoring of the pulps going into the mill machinery. It is a job customarily done by a paper technologist peering through a microscope to analyze the fibers in the mix. It is a slow process, and it needs to be speeded up so that new energy-saving technology can be introduced into paper mills, which are among the hungriest energy eaters in the nation's industrial family. When Kirsch completes this job, he fully expects to have a computer that will quietly, efficiently and continuously inspect paper fibers and decide whether their infinite degrees of fatness, skinniness, curliness, length or whatever are compatible with one another and with the grade of paper intended to emerge from the rolls.

In the nearby Technology Building, Dr. James Albus, project manager for sensors and computer control, works at upgrading the technology of automation, particularly as applied to what is called industrial robotics. Albus and his colleagues have a working robot (p. 88). Their creation has neither a name nor any of the elfin charm of Artoo-Detoo in *Star*

Wars. But it can make up its mind without having a human midget inside to tell it what to do next.

The robot is basically a geared black aluminum arm with a two-fingered hand on one end. The arm can swing from side to side, tilt up or down, and reach or withdraw. The hand can grasp or release and—an improvement on human hands—it can see. It carries a rudimentary electronic eye—a miniature TV camera mounted on the top of its "wrist."

The qualities that set the machine above the conventional automated device are its abilities to follow orders and then make independent corrections of error. Sent to pick up an object at any designated spot within its reach, the machine will obediently go to work. But if the target object is moved to another spot, about which the machine has not been informed, it will set out independently to find it. When the eye does see the target, the arm and hand will reach to retrieve it. If the object is placed beyond reach, the robot at first hunts for it but, finding nothing within its grasp, sensibly stops searching.

Here are both motor skills and a capacity for decision programmed into a computer. How far can the process be pushed?

"It's largely a matter of cost," says Dr. Albus. "This machine has seven motors. But look here at one human hand." He holds out his hand, palm up, and begins flexing fingers, thumb, palm, wrist. "At least 58 motors here alone—plus thousands of sensors for touch, heat, cold, pain and so on."

What about capacity to decide, to think, to create?

"Most of what we do or decide is the product of learning. Machines can be taught. There may be a finite dividing line between learned skills and an intellectual process—creativity, if you want to call it that. But I don't know where or what it is."

The NBS is more keenly conscious than most that

NBS at Boulder solves measurement problems that did not even exist until recently. Here, in a test of optical communications, laser beam is transmitted

the future of all skills, motor or intellectual, human or mechanical, depends on Man's capacity to find new sources of energy and to husband what he has. The bureau's scientists are deeply involved in these searches. For the past three years they have taken an active role in a most unusual partnership, sponsored by the Department of Energy, in which the United States and the Soviet Union are developing an exotic new method of electrical power generation called MHD. To oversimplify quite a lot, MHD—magnetohydrodynamics—holds that it is possible to generate electricity without turbines by expanding a very hot, electrically conductive gas between electrodes mounted perpendicularly to the poles of a magnet.

Theoretically, MHD can furnish the United States with a more efficient way to produce electric power. But there are still a number of significant *ifs*. Chiefly, the problems to be solved stem from the extremely high temperatures—in a range from 2,500 to 3,200 degrees C (5,400 F)—and the additives "seeded" into the burning gases to improve their conductivity. The combination results in an extremely corrosive environment within the MHD system.

And so to the partnership. At NBS, scientists search for materials durable enough to stand up under the

through a spool of glass fiber "waveguide." Glass threads carry light as wire carries electricity, thus can transmit information over long distances.

A neutron beam can peer into opaque objects such as this 3,000-year-old Chinese urn made of lead. Resulting image can reveal contents, flaws, corrosion.

extremes of temperature and corrosion inherent in MHD. Tests of American materials have recently been conducted at a facility in Moscow. As a result of this cross-fertilization of ideas, a 50-megawatt MHD pilot plant is now under construction at Butte, Montana, and current law calls for a full-scale plant in this country by 1990.

Searching, probing, testing goes on almost everywhere at both NBS campuses. At Gaithersburg the bureau's largest single laboratory tool is a two-story-tall reactor devoted exclusively to research. Unlike much larger nuclear-power plant reactors, the NBS atom furnace has more than 30 channels leading into and out of its core. Through these access holes experiments can be sent into the core itself, or streams of neutrons can be led out to probe experimental samples much as X rays do.

As a tool of enormous versatility, the reactor's fiery energy is turned to the service of many disciplines, from medicine and metallurgy to archaeology. For the past two years, a research fellow from the Smithsonian Institution has been a working guest in the reactor building. Seeking to trace the trade routes of antiquity in the Near East, Dr. James Blackman has been subjecting 4,000-year-old stone implements from Persia to the reactor's scrutiny. Among other experiments, Blackman has succeeded in demonstrating that black glass sickle blades and fragments of bowls, found in an archaeological dig near Shiraz, Iran, were fashioned from deposits of volcanic glass in the Lake Van region of eastern Turkey and at Lake Sevan in Soviet Armenia, roughly 1,500 kilometers (900 miles) away.

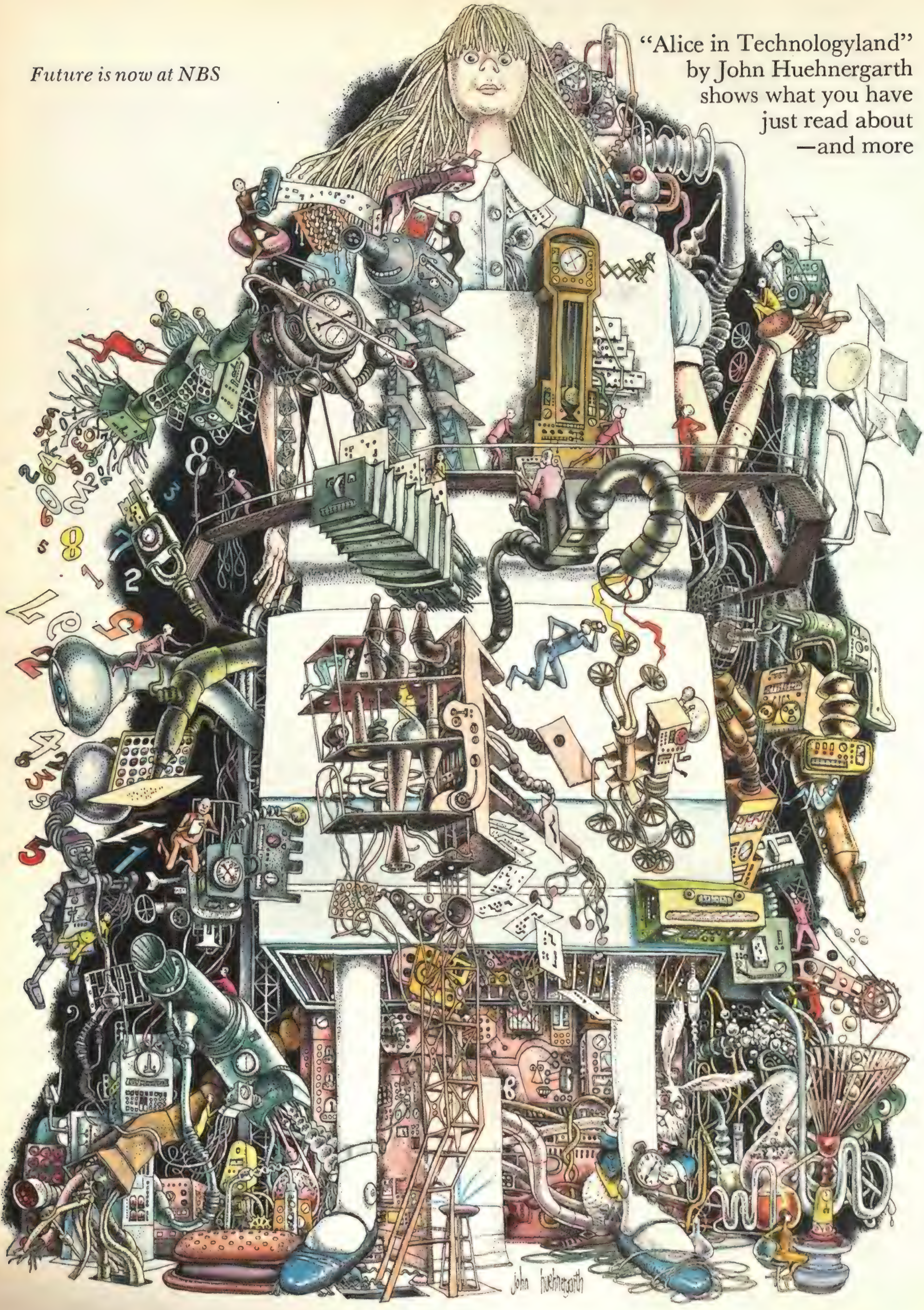
Not long ago the physicists in the neutron radiography group were asked by the Smithsonian's Conservation Analytical Laboratory if they would be interested in helping some Washington-area museums authenticate certain old paintings—in the same way that the Brookhaven National Laboratory on Long Island has done for a couple of New York museums. The answer was yes.

"It will be rather like developing a photograph," says a reactor scientist. "A neutron scan can penetrate much deeper than X ray. It will show things like whether there is another picture beneath the one on the surface, whether the signature has been painted over, the character of the artist's brush strokes, whether the pigments are ancient or modern.

"If the 'old' paintings in any collection turn out, unfortunately, to be really juvenile, we will be the first to learn the bad news."

Future is now at NBS

"Alice in Technologyland"
by John Huehnergarth
shows what you have
just read about
—and more



General Electric presents a future in your past.

General Electric has been around for one hundred years. That's half the age of our nation. A century of progress.

As you read the following pages, you'll be surprised to learn GE was working in areas years ago that are so relevant today. Areas that represent milestones in the progress GE has made during its 100 years. And you'll see how GE's concern for progress is continuing— to help solve the problems of today and tomorrow.

GE's roots reach back to this company, founded on October 15, 1878.

This ad appeared in September, 1925.

What a convenience electric light is

. . . and how much less it costs!

In the days of Governor Bradford, light was so expensive that the frugal Puritan family extinguished its single candle during prayers. The early settlers had to learn to make candles themselves—the most arduous of tasks.

Then light comes at a finger touch,—and it is more than 100 times cheaper than candle light. $1's worth of electricity will give much more light than $1's worth of candles.

So see light freely. A 75-watt Edison MAZDA Lamp will give more than twice as much light as a 40-watt Edison MAZDA Lamp—but will average only a third of a cent more an hour for current.

And use the right lamps. Edison MAZDA Lamps give full value for the current you use and there is a *right* size for every socket. Any Edison MAZDA Lamp Agent will advise you. He displays the sign shown at the left of the picture.

EDISON MAZDA LAMPS

A GENERAL ELECTRIC PRODUCT

Lighting led the way.

It was 100 years ago when Thomas Edison founded the Edison Electric Light Company . . . the company that became General Electric. The following year Edison invented the first practical light bulb.

Yet more than 40 years later, this ad was still trying to convince people of the convenience of lighting.

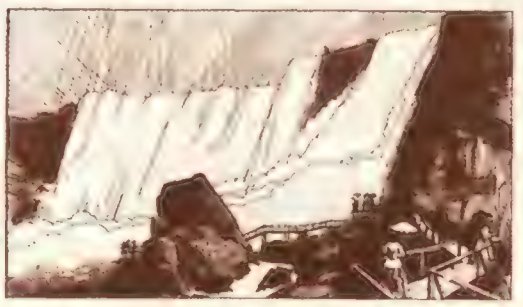
People don't need any convincing these days. Today, GE makes thousands of types of lights and comes up with a new idea in lighting every working day. In effect, GE never stops inventing the light bulb.

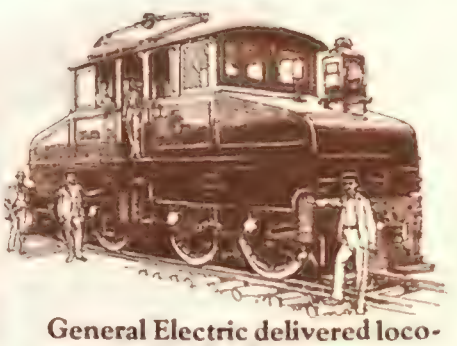
And GE is making progress by finding ways to provide more light and better light—at less cost and using less electricity.

The first practical light bulb helped the Age of Electricity get underway in 1879.

America's first central power station built by Thomas Edison on Pearl Street, in New York, 1882.

1894. Charles Steinmetz and other GE engineers helped make a success of America's first major a-c electric transmission project at Niagara Falls.





General Electric delivered locomotives for the first major conversion of a steam railway to electricity—1895.

This ad appeared in April, 1927.

A brand-new way to do homework.

There was a reason for that timeworn phrase "A woman's work is never done." It never was. Fifty years ago, her days were filled with hard, heavy, ceaseless labor. Because back then, just about every household chore was done by hand.

This ad talked about liberation. Talked about how electricity could take over housework at a modest cost.

Today, electricity works even harder in the home. Because each American home has so many more electrical appliances. And the average U.S. cost of electricity to run those appliances is still modest — only 3.6 cents per kilowatt hour.

Today, and in the future, you will find the GE monogram on the appliances that lighten your work load.

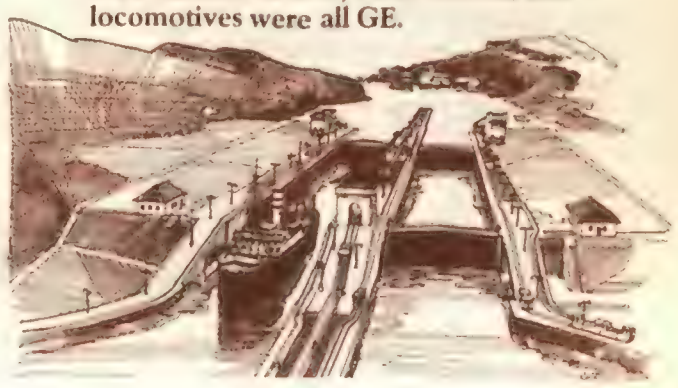
Ask your electric company or dealer to help you select the labor-saving electrical appliances best suited for your home.

There are few hard tasks left in the home which electricity cannot do at trifling cost. You will find the G-E monogram on many electrical household conveniences. It is a guarantee of excellence as well as a mark of service.

GENERAL ELECTRIC

GE pioneered industrial research when it opened this laboratory in 1900. Among the researchers: Charles Steinmetz, John Dempster, Willis Whitney.

Patents for electric fans were awarded to a GE engineer in 1902. First ones were actually built a few years earlier.



Opening of the Panama Canal in 1914. 1000 electric motors, lock controls and locomotives were all GE.

This ad appeared in January, 1918.

When Minutes Meant Lives

FROM our Army in France came a call for a light and mobile X-ray outfit. Those we had, and those the Allies had, were heavy, complicated and fragile. It would mean life to American soldiers if their wounds could be examined immediately, on the field, instead of in the hospitals to the rear.

The problem was given to the Research Laboratories of the General Electric Company, and the facilities of MAZDA Service, which include the knowledge and experience and technical skill of scientists and engineers, quickly developed the X-ray outfit needed. Incorporated in it was an X-ray tube of new and improved design, by virtue of which cumbersome auxiliary apparatus was eliminated.

The engineering skill of allied industry, of Army officers, and of roentgenologists was called upon to complete the outfit, and in an astonishingly short time these units, truly portable, were being shipped to France. The new X-ray outfit did work with one tube for which other machines required a variety of tubes. Further, it weighed less than half as much, and was three times as powerful as the best field equipment then available. This outfit was made standard by the United States Army, it was used in the fields, and it replaced more intricate apparatus in many of the base hospitals.

The way of its production was this—MAZDA Service is responsible for the present efficiency of the highest type of incandescent electric lamp, the MAZDA lamp, and there is no type, shape or size of bulb or filament that has not been made and tested in the Research Laboratories. The X-ray tube, the vital part of the outfit, is a younger cousin of the incandescent lamp. To the making of this tube were brought to bear a unique knowledge of bulbs and filaments, an unequalled laboratory and manufacturing equipment, and the technique of the chemists, physicists, metallurgists and engineers of MAZDA Service. These men triumphantly and swiftly solved the difficult problems of development and manufacture.

The portable X-ray outfit forthwith went overseas to save American lives.

The facilities of MAZDA Service produced it when the need came, and humanity is richer for its possession.

RESEARCH LABORATORIES OF GENERAL ELECTRIC COMPANY

MAZDA

A new look for doctors.

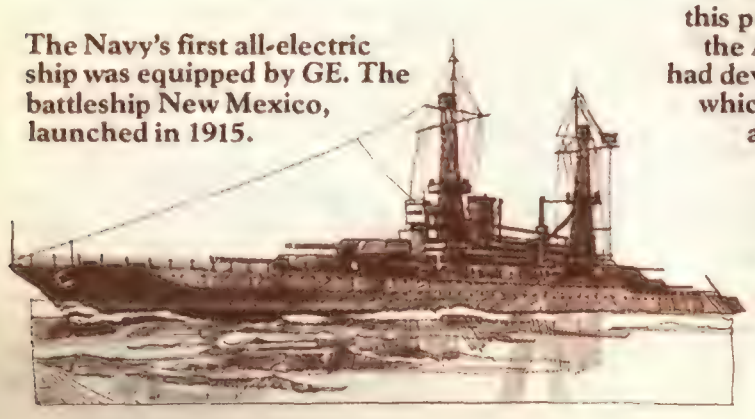
It's about 80 years since Roentgen discovered the "unknown ray," the x-ray. But for many years its use was limited because early x-ray tubes were very unpredictable.

Then Dr. W. Coolidge of the GE Research Lab came up with something that became the basis for all modern x-ray—the "hot cathode" tube. The ad at left talks about one important result of his discovery.

GE is still coming up with new technology. They recently built a total body scanner—a computerized unit that takes tens of thousands of x-ray readings in seconds. So doctors can see what they could never see before without surgery.

X-ray is only one area where GE ideas and medical equipment help doctors diagnose the ills of people.

The Navy's first all-electric ship was equipped by GE. The battleship New Mexico, launched in 1915.



Dr. W. Coolidge built this portable x-ray for the Army. In 1913 he had developed the tube which is the basis for all modern x-ray.

In 1921, a GE supercharger pushed a biplane up to 34,509 feet, a world record. This was one of many GE aviation "firsts."

This ad appeared in September, 1925

Clearing the air.

A lot of people are surprised that there have been companies concerned about pollution for many years. One of those companies is General Electric.

Take the ad at right. It tells the story of a tug that didn't smoke. Another ad on these pages talks about trains that didn't smoke, either. Throughout industry GE was developing ways for electricity to take over from steam.

Today, GE is still at it. With better ship engines, trains, motors. With nuclear power plants that put less smoke in the air than a match. And jet engines that leave no black marks in the skies.

And in the years to come, GE will continue looking for ways to keep smoke out of the skies.

Tugboat *Van Dyke 3* towing oil barge from Philadelphia to Boston.

What is missing in this picture?

All electric equipment for this boat, and for two sister ships, was manufactured by the General Electric Company; which also makes electric motors large enough to drive battleships and small enough for sewing machines, washers, vacuum cleaners, and fans. Let electric motors work more for you.

Even a child can answer—this tugboat has no funnel.

It has no steam engine, either. No bunkers full of costly coal. No stokers. No smoke. No clouds of steam.

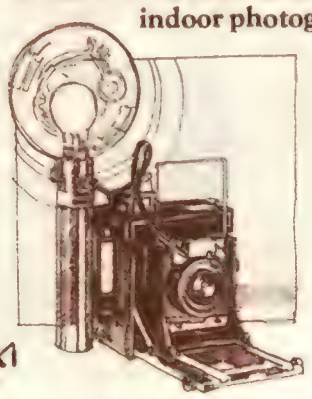
Clean electric motors, supplied with electricity by oil engine driven generators, keep this trim little boat continuously and inexpensively at work.

GENERAL ELECTRIC

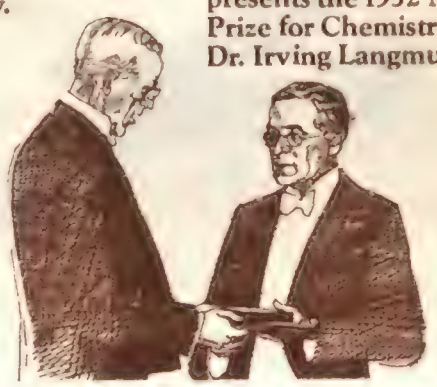
Many Americans remember their first refrigerator as this "Monitor Top," introduced by GE in 1927.

Only a few were lucky enough to have this GE TV set. It received the first TV broadcast ever...in 1928.

GE introduced the photoflash bulb to the U.S. in 1930. It revolutionized indoor photography.



King Gustavus V of Sweden presents the 1932 Nobel Prize for Chemistry to Dr. Irving Langmuir of GE.



This ad appeared in September, 1923.

1903
Twenty years ago this noisy, smoky railroad yard was New York's greeting to its visitors.

1923
Now down underneath these homes and hotels, smooth-running electric locomotives and motors handle 600 trains a day.

This avenue was a railroad yard

In 1910 the lines running into New York's Grand Central Terminal were electrified. Away went the smoky locomotives; the tracks were covered over; and 40 acres of railroad yards have become the beautiful home section of Park Avenue.

One glance explains why the valuation of real estate in this section has jumped hundreds of millions of dollars.

It is the business of electricity to abolish smoke and noise, to improve lighting, and transfer heavy burdens from the shoulders of men to machines. The General Electric Company makes the equipment and supplies with which electricity works.

GENERAL ELECTRIC

Getting people moving.

Just about every city in the country has had a face-lift over the years. The ad at left talks about one of the most dramatic ever. The transformation of a grimy railroad yard into choice real estate.

The yard built up as more and more travelers poured into New York City. Then came the non-smoking GE locomotive. So tracks and yard could be covered over to become famed Park Avenue.

Today, cities are still tackling the problem of getting people into their centers. And electric mass transit again offers the solution. Swift, comfortable, clean-running trains that carry hundreds at a time.

Tomorrow? Trains may look totally different, but GE will be working on new ways for electricity to do the job.

America's first jet took to the air on Oct. 1, 1942. Jet engines built by General Electric sent it aloft.

Closest thing to alchemy ever achieved by man: the turning of graphite into Man-Made™ diamonds by GE research in 1954.

World's first licensed nuclear power plant, built by GE in California. It started producing electricity in 1957.

This ad appeared in January, 1925

Using your resources.

As you can see here, GE was worried about saving natural resources a long time ago.

Today, U.S. supplies of coal are the largest in the world. But GE is still working at ways to make them last longer. One is through a process called "coal gasification" which allows low-grade coal to be efficiently used to make electricity.

But that isn't all. GE is also developing other sources of energy to make electricity . . . sources that are almost limitless. The atom, the sun, the winds.

Everybody relies on electricity to do so much. And you can rely on GE to find new ways to keep making the electricity we need.

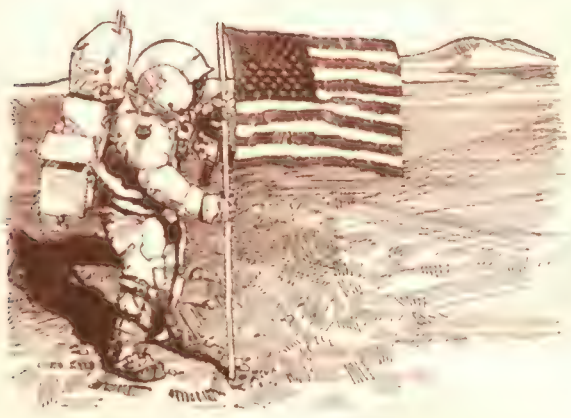
The world's biggest coal saver

On this machine is a name plate bearing the monogram of the General Electric Company—the same monogram that is on the little motors that run labor-saving household machines for you. This monogram is more than a trade mark: the letters G-E are the initials of a friend.

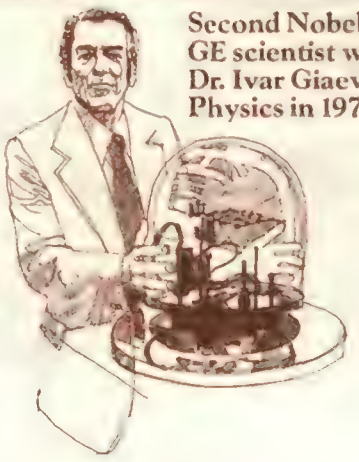
This is the largest hydro-electric generator in the world, one of three new giants installed by the Niagara Falls Power Company. Two million people share in the increased electric light and power supplied by these great generators.

Each of these machines will save the equivalent of 700,000 tons of coal a year.

GENERAL ELECTRIC



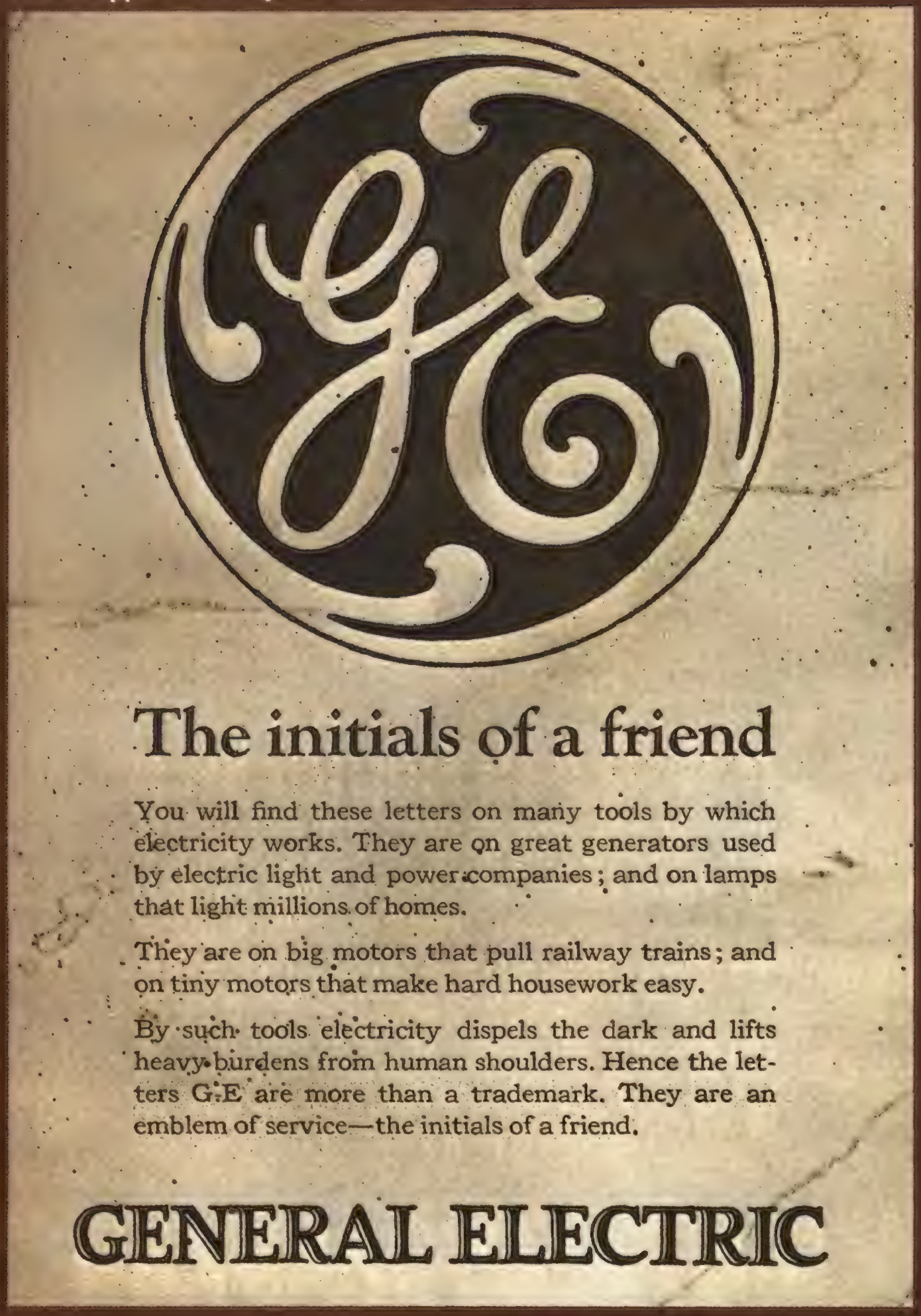
1969. Man first stepped on the moon. GE contributions to the Apollo program included computerized system that checked out 3000 valves and switches in 1/12 second.



Second Nobel Prize for a GE scientist was won by Dr. Ivar Giaever for Physics in 1973.

GE 100
1878 - 1978

This ad appeared in September, 1923



The initials of a friend

You will find these letters on many tools by which electricity works. They are on great generators used by electric light and power companies; and on lamps that light millions of homes.

They are on big motors that pull railway trains; and on tiny motors that make hard housework easy.

By such tools electricity dispels the dark and lifts heavy burdens from human shoulders. Hence the letters G.E are more than a trademark. They are an emblem of service—the initials of a friend.

GENERAL ELECTRIC

Some things never change.

This ad has long been recognized as one of the best of the past 100 years. It stated a philosophy of doing business — to make not only good products but products that could help human progress.

When General Electric first started, there was no way of knowing that the GE trademark would eventually be found on refrigerators, air conditioners and TV sets. Those items just didn't exist. Even today, people are surprised to find the GE trademark is also on such things as space satellites, radar and plastics.

Who knows? 100 years from now, those initials might be found on a space vehicle carrying colonists to another planet.

The GE trademark will continue to be "an emblem of service — the initials of a friend."

100 Years of
Progress for People

GENERAL ELECTRIC

KEN'S
LIL' VALLEY YOUTH ASSOC.
IN MEMORY OF OUR TWO ELEMENTARY WARRIORS WHO WILL NEVER BE FORGOTTEN. WE CUT UP THE LETTERS OUR MITED AGAINST THEM BUT EMERGED A NEW SENSE OF UNITY AND BROTHERHOOD IN OUR COMMUNITY — THEIR DEATHS WERE UNNECESSARY BUT NOT IN VAIN
LA RAZA
2875
634
LA RAZA
100% CITIZENS
POR FAVOR
3637

Lil' Valley gang mural at Ken's Market commemorates deaths of boys killed in street fights. The patchwork of themes covers the traditional values of family, education and religion.

By Martin Zucker

Walls of barrio are brought to life by street gang art

Neighborhood walls in East Los Angeles now carry messages for family, religion, education as opposed to deadly violence

Ken's Market, one of those disappearing species of mom-and-pop grocery stores, stands at the corner of Sixth and Bonnie Beech in East Los Angeles. Inside, Kenji and Yaeko Nagaishi, the Japanese-American proprietors, dispense everything from tortillas to toothpaste to their Mexican-American clientele. Outside, the market walls dispense a different commodity: paintings that plead for the traditional values of family, religion and education and an end to violence, and for preservation of culture, history, hope.

A mural covers the whole south facade of the store. It was put up several years ago after some neighborhood boys were killed. On the front window of the store, an artist comes to paint white crosses and gravestones and adds the names of any boys who have been recently killed. Since 1973, 14 names have been added.

"It all started because the kids were messing around with rival gangs," says Mrs. Nagaishi. "One of the boys was shot walking down the street. The other boys were going to get even. A second boy was stabbed and he died. And so it went, one by one. We have seen some

Photographs by Leonard Nadel

Neighborhood youths earn money for painting their first mural under the Citywide Mural Project.

awful things here. Most of the kids are good. It just takes a few to make the whole group look bad."

The neighborhood youths belong to a gang called Lil' Valley. They have little love for their peers outside their territory, even though they are all Chicanos. The mural at Ken's Market is a memorial to the Lil' Valley boys "whose youthful lives were destroyed brutally," says a sign attached to the painting.

Hundreds of murals have appeared on East Los Angeles area walls. They rise up from weed beds and graffiti. They chronicle the complaints, wounds, roots and dreams of impoverished Mexican-Americans. Both professional and amateur artists, sometimes working for money but mostly for little or none, take kids off the streets to help them express in painted pictures the feelings they can't express with words.

The barrio—Spanish for neighborhood—fans out eastward for miles from downtown Los Angeles. Los Angeles is home to more than a million Mexican-Americans, called Chicanos, and an unknown number of illegal Mexican immigrants. One hears as much Spanish as English in the bustling streets.

The labor force is largely unskilled. Salaries are small and families big. Unemployment runs high and welfare is a way of life. Graffiti, dope and frustration abound. The barrio is crisscrossed by freeways and crowded with factories. Together they produce a conspiracy of noise, pollution and prisonlike walls.

Chicanos feel distant from the good-life Anglo culture that has made Southern California famous. Parents feebly attempt to control children with *campesino* (rustic) values in a new world that doesn't accept them. A kid has to struggle to make it through school, fighting perennial pressure to drop out and find a job to bolster the family finances. Too often they drop out.

Neighborhood youngsters, looking for identities and allegiances, congregate at street corners, in parks and at taco stands. They give their gangs names like White Fence, Clover, Evergreen, *Cuatro* Flats, *Primera, Tercera.* Some of the names go back 30 years. Fathers who used to be in White Fence now have sons in White Fence. The kids call each other "home boys."

"They aren't gangs with formal leaders that get together to rob," says Judy Baca, a leading figure in the mural movement. "You grow up in the White Fence neighborhood and you belong to White Fence whether you want to or not. A lot of these kids don't relate to their families, so the group becomes the family. Each generation has its own clique. It goes by age. The kids are practically born into the gangs."

The gangs have all developed highly stylized signatures, called *placas,* which they spray or scrawl on walls, store fronts and anything that doesn't move. The *placa* is a territorial warning to other gangs.

According to police records, there are about 250 known gangs in Los Angeles County. Of these, 180 are Mexican-American and nearly 45 of them are concentrated in the barrio. Los Angeles Police Department investigator Gary Douglas says. "Of the 17 geographical divisions in our jurisdiction, here are the highest rates of part one [serious] gang crimes." Trouble can start when one group enters another's territory and puts its *placas* over the local *placas.* A fight over a girl

Martin Zucker, a free-lance writer in Los Angeles, wrote about the Arthur Gilbert collection of micromosaics for SMITHSONIAN *in May 1977.*

The panels represent their culture dating from pre-Colonial Mexico to contemporary barrio.

HOME BOY KILLING HOME BOY
FROM ANOTHER BARRIO ALLEY
WHAT FOR A BARRIO NAME
ON A CORNER POLE GANG
WAR IS NOT GOING TO DO IT
WHAT WE NEED
IS UNITY

Artist Manuel Cruz painted this small mural at community center where brutal gang fight occurred.

at a party can set off a snowballing feud. "One group gets some guns, drives by in cars, and starts shooting," says Douglas. "A lot of innocents always get hurt. The chain of revenge can last for years. The armaments these kids have are unbelievable. Automatics. 22s. Shotguns. You name it."

Manuel Cruz, 47, is an artist, minstrel, idealist, Chicano revolutionary and home boy grown up. He knows the street scene and still lives in the same barrio where 30 years before he did his share of gang fighting.

"It was different in those days," he says. "Fifty or 60 guys would assemble and get down on another gang. Sometimes there'd be knives and chains, but mostly it was fists. In the late Fifties it became easy to get guns. The barrio began dividing into little barrios as more Chicanos and Mexicans came in. Nowadays there are fewer guys in a lot more groups. They go with guns and shoot from cars."

The shootings and deaths disturb and move Chicano artists like Cruz. He has even written a song about it. But his prime medium is the brush and he has painted murals on garage walls, laundromat walls, apartment building walls or any flat surface he gets permission to paint on. Sometimes he receives a few hundred dollars from a merchant who sees a chance to rid the premises of galloping graffiti.

One of the Cruz murals is *La Evolucion del Barrio;* it occupies the lower length of a two-story apartment building wall. The mural makes a historical parade from Aztec beginnings, through the Spanish conquistadores, Mexican independence, the gold rush and Cesar Chavez and the United Farm Workers. The mural comes to an ironic halt with banner imploring *"Raza Unida"* (United Race) over body of a slain home boy.

"This mural is in *Tercera* territory," explains Cruz. "*Tercera* means third for Third Street. There's a lot of bad blood between the guys from *Tercera* and the guys from *Primera* on First Street. Home boys in both gangs have been killed, so I dedicated this mural to all of them. I want the wall to speak out and let them know, no matter what group they are in, that we are all descendants from the same Aztec forefathers. We are one race. We have enough problems without killing each other."

Several miles away, in the territory of the gang known as East Los, is a small Cruz mural on the side of a community center (above). A girl is sobbing in front of a home boy's grave. The mural was motivated by a gang brawl in the center several years ago when Cruz was teaching arts and crafts there.

What do the home boys think of these murals? "They say, *esta firme,* it's solid," says Cruz. "They come and tell you, *ponga le,* do it. They don't know how to express themselves but they like the idea that you are talking for them."

Judy Baca's first effort in organizing members from different gangs resulted in *La Abuelita* mural.

Pride of lions is ignored by passersby in unfinished mural

The Chicano mural movement is rooted in the tradition of Orozco, Rivera and Siqueiros, who depicted the social dilemmas of another time. Unlike those Mexican masters who filled monumental walls, the Chicano process is entirely public and almost any wall is good enough.

Willie Herron, one of the best Chicano muralists, picked a back alley wall for a screaming, surrealistic account of his younger brother being beaten up. "Ten dudes jumped him at that wall," says Herron. "I wanted to show the experience of the blood, of him being loaded on drugs and the whole gang situation, and of him trying to break through the barrier that's always been there holding him back."

At Estrada Courts, nearly 50 mural walls have turned a once-drab, low-rent housing project into a 20-acre outdoor museum that actually attracts foreign tourists and artists. C. W. Felix, a successful Chicano artist whose nail reliefs have been exhibited at the Smithsonian Institution, organized the mural society at Estrada "to keep the kids busy during the summer and get them off the streets." For the past five summers he has obtained up to 210 paying jobs backed by federal funds. "Every vacation the kids can look forward to the jobs. Before this there was nothing."

The funds pay for salaries as scrapers, wall painters, sketchers, detailers and fine painters. At a typical mural, several youths, shadowed by their little brothers and sisters, work with a volunteer artist. The paint, brushes and other materials come from money raised at annual Estrada Courts fiestas. When the fire department contributed a set of old, unused scaffolding, the neighborhood false alarm rate dropped from 100 to five a month.

"We're proud of the murals," says Javier Maya, 18, one of the Estrada Courts home boys. "Before, the blank walls were filled with nothing but graffiti. It's a lot better now than looking at all that mess."

Felix and a committee from the 1,400 resident families try to "keep the mural themes positive, but life isn't all that hunky-dory, so negative work gets in too." The best executed wall at Estrada happens to be the most negative one there, a black-and-white narrative in striped, shocking realism by Herron and Gronk that attacks police methods in the barrio (far right).

"We have come closer together as a people through the murals in saying that we Chicanos have a lot of culture and history," says Felix. "As projects, the murals give the kids a sense of pride, of accomplishment, of involvement and responsibility. You can't say the murals have come to save everybody but they do contradict what a lot of people think, that Chicanos are just into gang fights and writing on walls."

Judy Baca is a tough, bright and attractive Chicano artist, who, more than any other single person, is responsible for the great proliferation of murals in East Los Angeles and from there out to the rest of the city. Little did she realize what she was starting when she brought kids from different gangs to paint a mural of her grandmother in an eastside park (above, left).

in Estrada Courts. When completed, painting covered the graffiti.

Art signed by Herron and Gronk reflects police methods in this stark newsreel-style mural.

Judy tells her story dressed in a faded sweat shirt and paint-splattered jeans, sitting behind a decrepit desk in a former police station lent to her public arts program by the city. She spends a lot of time on the telephone trying to drum up difficult dollars for projects.

In 1970, she was employed by the city to teach art in five different eastside parks. "I got to know all those kids who were sitting around drinking wine, playing dominoes or sniffing glue," she says. "There was nothing for them at the parks. No program that was interested in them. They just hung around, aged ten to 25, and just didn't go to school. There were no jobs for them and there aren't many now.

"I tried to relate to them through art. Of course being a woman helped. I was no threat to their machismo. Had I been a man, they would have been suspicious of my presence in their territory. After months and months, some of them started bringing in their papers, their drawings, sketches of their *placas,* and even showing me their excellent tattoo work.

"One day I got the idea of trying to bring some of these kids together, kids from different groups who showed an interest in art. To take Toro from White Fence, Pepe from Evergreen, Fernando from *Cuatro* Flats, take kids from each of these groups and do a project large enough—a mural—so it couldn't be done individually, not without them and not without me, and not without each other."

At a local rehabilitation center she convinced the director to give her 20 jobs from Neighborhood Youth Corps money for her scheme. She went back and told the kids they had summer-long jobs at $2.25 an hour. Were they willing? They were.

"The kids were from four gangs and when I brought them together they were sullen and tense. I didn't know whether the experiment would work. I even resorted to improvisational games to create communication. It took several days to break down antagonisms and mistrust to the point where we could proceed. Then we went to the library and I showed them Picasso, the Mexican masters, art they had never seen. Then we began to talk about the first mural, a painting to fill the inside of a park bandshell (far left).

"We decided to do *La Abuelita*—the grandmother—who is a comforting focal point in the family. Putting *la abuelita* in the band shell with extended arms would be like reaching out to embrace all the brothers and sisters. We settled on a picture of my grandmother and outlined the mural in crayon.

"But there was no paint, no scaffolding, no brushes. We borrowed. begged and scrounged and came up with the necessities." She laughs as she recalls the time she once took a break and behind her back some of the boys painted *la abuelita's* collar a shocking pink. In the middle of the work, city officials took notice and allotted $300 to the project.

That first summer, Judy and her crew—calling themselves *Las Vistas Nuevas* (The New Look)—completed the band shell and four other eastside panels. However, the glow of accomplishment was always dimmed by

Some of the barrio youths congregate at mural that links their Aztec past with the urban present.

the hard realities of the barrio. "Their lives are so vulnerable," says Judy. "One minute they are there and the next they can be dead. While we were working, one of the boys was arrested for murder. Right after the mural was finished, Fernando was stabbed 13 times and almost died, and Pepe was back on heroin."

News of the murals spread. Members of the White Fence Gang sought out "the mural lady." They wanted a mural at the entrance to their local recreation center (opposite).

"It took nine months to complete," recounts Judy. "Every single person working for me was in jail at one point or another during the mural. In the beginning neighbors said we shouldn't do anything for the kids, that they were all hoodlums."

Judy finished the mural feeling depressed and "burned out." She spent the following year doing a big mural on the mellower Los Angeles westside. But the eastside was on her mind. She approached the Los Angeles City Council to fund a mural brigade for the gangs. Most of the councilmen didn't have gang problems and were uninterested. Refusing to give up, she redesigned her concept and called it the Citywide Mural Project to incorporate senior citizens and children as well as gang youths. The revision was approved and she received $130,000 to operate for a year.

One of the first projects was the 500-foot-wall around the Little Sisters of the Poor Convent in East Los Angeles. The wall was declared neutral territory and 65 kids worked for eight weeks with pay under 13 volunteer artists to paint a series of panels covering community themes. Subsequently, 200 artists working with 1,000 young and old helpers have painted more than 185 murals in the black, Chicano, Asian-American and Anglo areas of the city. Youths from 15 major gangs have participated. Money elicited from municipal and private sources supported the activity.

Her original inspiration to bring different people together is finding massive expression in a mile-long mural—the world's largest—on a flood-control channel wall. The project is already a one-quarter-mile long pictorial parade of California minorities history.

"Realistically, I don't think you can rehabilitate these kids this way. Basically all we can do is give them one positive experience out of a life that is largely negative. In this one way, these kids are doing something they feel good about. They are winning. They are tasting success.

"You find somebody and give him one quick success and for a few days or weeks he is able to turn his anger and frustration into something positive. But then what? There is no money to follow up, to give them some usable skills to continue the success. Rarely is there a scholarship or money or a sustained program for them. I bring them up a little and then they crash. And that's what a lot of them have done. Sometimes I get disillusioned beyond belief, because people don't seem to understand that these youths are everyone's responsibility.

"The least you can say is that we have elevated the arts in the eyes of these kids and the community. You can go into a neighborhood and ask who the *artista* is and they will all point proudly to that person."

The White Fence gang painted a face to cover entrance of the Wabash Recreation Center, but their added embellishments gave the lady snakelike hair and she turned out to resemble a Greek Medusa.

2765

"Hello, we've got the car you ordered, Sir."

Once every 32 seconds a car is stolen.[1]

Auto theft is no longer a "cottage industry." It's a 1.6 billion dollar a year business.[2]

In 1977, 948,024 cars were stolen. If that seems a meaningless statistic to you, what ought to make it meaningful is the fact that you pay for auto thefts through your insurance—whether your car is stolen or not.

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Can anything be done to stop auto theft? A number of things:

Lock your car. Some 40% of stolen cars are driven away with the keys owners left in them.[3] In Boston, where 1 in every 35 cars was stolen in 1975, a "Lock-your-car" campaign, run by the National Auto Theft Bureau and supported by many institutions including Ætna helped *cut theft 48% in a two-year period.*

Install anti-theft devices such as locking systems, out-off switches and security alarms. While less effective against the professional thief, they are a known deterrent to the amateur.

New laws can help. Ætna supports, for example, the National Highway Traffic Safety Administration's recommendations to make anti-theft devices standard equipment.[4]

We also back the recommendations of a New York legislative committee for identification numbers on car parts most often stripped, licensing of businesses that sell or scrap cars and accurate records kept of all transactions. We urge other states to consider these ideas.

Auto theft can be cut. Auto insurance costs can be controlled. Don't underestimate your own influence. Use it, as we are trying to use ours.

Ætna wants insurance to be affordable.

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1 While private passenger car registration increased 180% between 1949 and 1974, *thefts increased a whopping 493%.*

2 There may be worse to come: Auto theft rings have expanded their operations to offer auto parts—some 20% of cars they steal now wind up in the "cutting factory."

3 According to a 1978 report from the New York State Senate Committee on Transportation, 20% of stolen cars have the keys left in the ignition while another 20% have keys "hidden" by the owner on the visor or other places.

4 Until anti-theft devices become standard equipment, we urge you to have them installed before other optional equipment that makes cars more attractive to the thief.

For a better understanding of the problem of auto insurance costs and what you can do about them, write Influence, Department N, Ætna Life & Casualty, 151 Farmington Avenue, Hartford, CT 06156.

Ætna
LIFE & CASUALTY

By Lynn White jr.

Medieval Europe foresaw planes, cars, submarines

Middle Ages weren't 'dark' since invention found expression in architecture, mills, roads —and ideas bearing fruit in 20th century

In the Americas and Europe today, educated people normally think of the path of our Western culture as starting with the ancient Greeks and Hebrews, then running through the Romans and the Latin Middle Ages to ourselves. In some fields—such as religion and art—this interpretation has merit. In technology, it is less useful. While nothing of ancient Greek or Roman engineering perished along the road, the attitudes, motivations and most of the basic skills of modern technology before the electronics revolution originated not in Mediterranean antiquity but during the "barbarian" Middle Ages.

Despite their geometry, the Greeks of the Periclean Age could not put together a good beamed roof for the Parthenon; the solution of such problems had to wait for Roman engineers. Though machine design developed swiftly, involving pulleys, cogwheels and screws, the devices were not intended for production of goods, but rather for increasing the magnificence of rulers, the mystery of temples, the lore of astrology.

Romans overran the Greek world and enjoyed these Hellenistic devices, but did not improve on them. The great Roman contribution to engineering was in structural design. Yet the dome of the Pantheon, an overwhelming achievement, is likewise overwhelming in its extravagance. Having looted the Mediterranean world, the Romans were careless with cost accounting. One reason why so many Roman structures have survived is that the mass of their masonry is out of all proportion to function. For example, Roman architects often incorporated segmental arches into solid walls to reduce the vertical pressure on lintels. But in their bridges, aqueducts and the like, they clung to the semicircular arch, overlooking the fact that considerable masonry could be saved by using broader arches of less than 180 degrees.

When Christianity became the official religion of the Roman Empire, it naturally built its Western churches in the late-Roman manner, with wooden ceilings and beamed roofs. During the early Middle Ages, liturgies grew steadily more elaborate, and apses were increasingly filled by carved wooden choir stalls and textile hangings. For celebrations altars were flooded with light from masses of lamps and candles, especially in Northern Europe with its long, dark winters. Occasional catastrophic fires resulted, reaching the timber ceiling and roof and destroying the entire edifice.

By the tenth century architects were beginning to provide fire protection by increasing the height of churches and by replacing the combustible ceiling with a thin shell of masonry vaulting to shield the roof beams from sparks. Both arches and vaulting, however, remained semicircular, which meant that as nave and choir grew loftier, the lateral thrust of the vaults required ever more massive walls and buttresses. All stone was quarried by hand, and the transport of heavy material was costly. By the late 11th century it must have seemed that limits of financial feasibility had been reached, especially in comparison with the Church's charitable obligations.

Then, suddenly, a new idea came out of South Asia.

French miniature (c. 1450) from *The Clock of Wisdom* shows woman sage explaining workings to an author. Mechanisms arrayed indicate deep pre-Renaissance interest in timekeeping technology.

Invention in medieval times

Some 900 years earlier Buddhist monks in India, for purely decorative purposes, had invented both the horseshoe arch and the pointed arch. Both gradually worked their way westward. The former, which structurally had no advantage over the semicircular arch, set down its deepest roots in Spain. By the tenth century the ogival, or pointed, arch was dominant in Egypt and much of North Africa. Thence it moved across the Mediterranean to Amalfi.

In 1071 the church of the Benedictine motherhouse of Monte Cassino was rebuilt with an entrance porch of pointed arches and vaults. The intention seems to have been purely ornamental. Nine years later the abbot of Cluny in Burgundy, already planning what was to become the greatest monastic church of Europe, visited Monte Cassino. Either he or his engineers saw that those pointed arches on the porch would shift the lateral thrust downward and thus permit use of lighter, more economical walls and buttresses.

Use of the new structural forms spread and their technical possibilities were advanced. In 1144 the great Abbot Suger completed the restoration of the abbey church of Saint-Denis, near Paris, which is generally regarded as the first fully realized Gothic church. The 56 years between 1088 and 1144 represent roughly the same span required in 19th-century America for I-beam construction to develop into the coherent skyscraper. Obviously Gothic architects had no intention of erecting cheap eyesores. Yet they clearly considered problems of cost, which the Romans ignored.

Road building provides a further example. Roman roads were primarily built for marching legions and were thus too steep in places for wheeled traffic. The massive surfaces of stone slabs cemented to a rubble foundation did not allow for contraction or expansion with temperature changes. Water seeped under the slabs and in freezing weather they became loose and cracked. Maintenance remained a great and perpetual expense. In the West in the 12th century, city paving was usually done with squared stones set in sand or loam that provided for expansion and made maintenance fairly easy. By the 1400s, especially in heavily populated regions like Flanders, interurban roads were being paved in this way.

The greatest technological concern of the post-Roman West has been with the reduction of human and animal labor. The water mill appears in the Mediterranean world in the first century B.C., and the Greek poet who gives us our second bit of evidence for it is sensitive to its beneficence: he urges the slave women, who formerly rose early to grind the day's flour, to sleep late because the water spirits have assumed their task. Note that these represented real technological nymphs, not just poetic conceits.

Water mills did not become common in Roman times, and there is no firm evidence that the Romans applied waterpower to any process other than the milling of grain. Perhaps the ancients were a bit fearful of harnessing sprites.

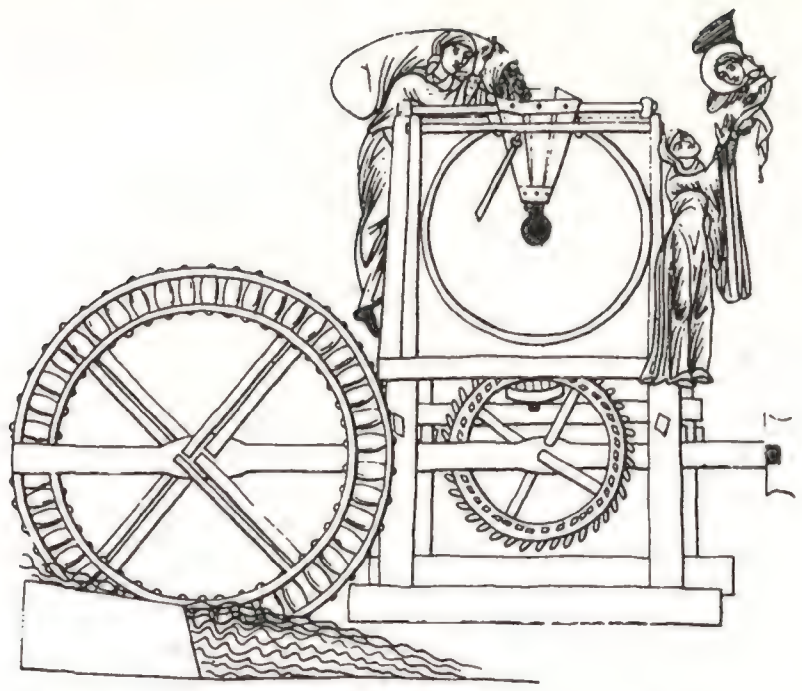
The major spread of the water mill in Europe occurred after the Roman Empire in the West had disintegrated and the population was generally Christianized. The first clear evidence of waterpower used for any industry other than the milling of cereals comes in the ninth century. Later, the sketch of the abbey of St. Gall in Switzerland shows where mills were built with powerful stamps designed to make mash for beer. By the 11th century every village had at least one flour mill and industrial applications of waterpower were increasing rapidly (opposite, above).

Windmills become a fad

Dating from about the middle of the 12th century, two independently written, enthusiastic monkish descriptions tell how, at St. Bernard's abbey at Clairvaux, mills fulled cloth, tanned leather, worked forge hammers, automatically sifted the flour that they had ground, did laundry and generally made themselves useful. This exhilaration over new productive devices, the conviction that they were profoundly good in human terms, the clear sense that further inventions would follow—all these feelings demonstrated a departure from Greek-based antiquity to a technological atmosphere which has increasingly surrounded us.

New developments, in fact, came rapidly. In the early 1180s the horizontal-axle windmill was invented,

Dr. White, university professor of history at UCLA, is the former president of the Society for the History of Technology. This is adapted from his chapter in The Smithsonian Book of Invention, *soon to be distributed.*



Undershot waterwheel in this 12th-century sketch rotates mill grindstone by angled cogs of geared wheel.

probably in eastern England. It proved very useful in flat regions where the sluggish flow of streams rendered water mills ineffective—unless one built a dam, which often flooded agricultural land. By 1192 European-style windmills were being built in Syria by German Crusaders. Indeed, toward the end of the 12th century windmills were spreading as rapidly as cinema would in the early 20th century. Within little more than a decade of their first appearance, the Pope was trying to tax them.

By the second half of the 13th century, many Western Europeans considered invention a practical human undertaking. People had no notion that scientific findings could solve technological problems. Nonetheless, Western society was metaphorically ready to try its wings.

Shortly after the year 1000 a monk at Malmesbury Abbey built a glider, flew some 600 feet, and then crashed because, as he said, he had forgot "to put a tail on the rear end." An isolated experiment—but by about 1260, Friar Roger Bacon was writing not only about "flying machines . . . in which a man . . . may beat the air with wings like a bird" but also, in the same sentence, about "machines . . . by which the largest ships . . . will move faster than if they were filled with rowers; wagons may be built which will move with incredible speed and without the aid of beasts . . . machines will make it possible to go to the bottom of seas and rivers."

In 1335, a learned Italian physician, Guido da Vigevano, who was interested in machine design, presented to the King of France a volume containing drawings of new engines, including the first known automobile, a vehicle powered by men working the first known crankshafts. Another of his sketches showed a submarine with paddlewheels operated from inside by crankshafts. A third sketch depicted a siege tower powered, like the automobile, by internal man-powered crankshafts supplemented, in case of a good breeze, by a windmill that fed power into the gearing.

Guido's novel ideas seem to have found their first use in theatrical machinery at the courts of France and Burgundy. In the 15th century they became part of general European literature relating to engineering.

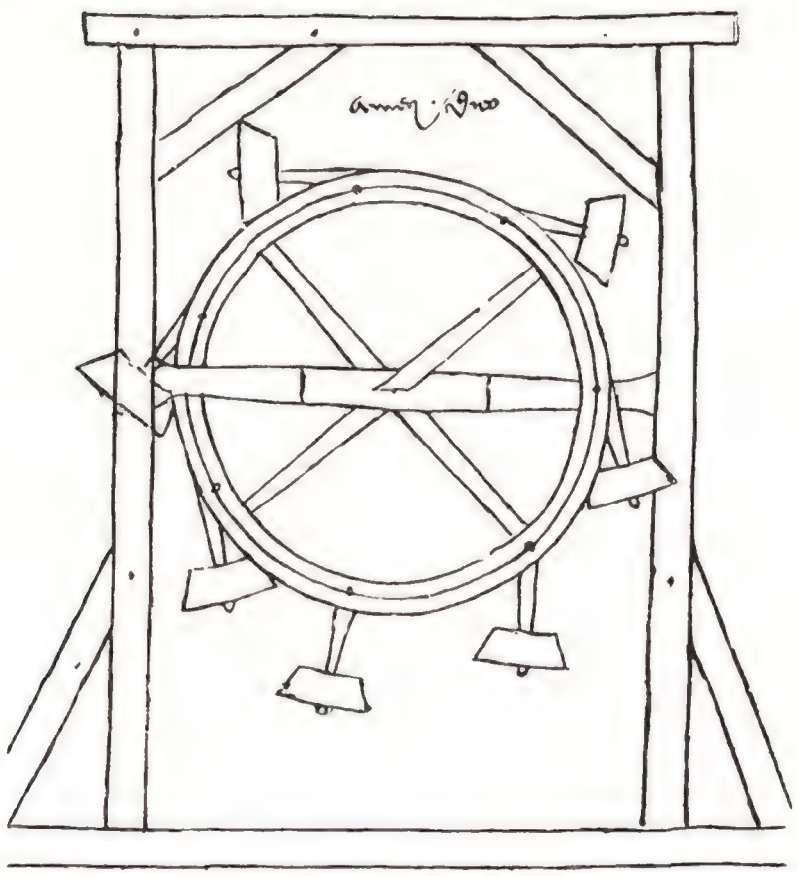
Europeans were becoming quite aware of invention. Its growing importance is illustrated by a vernacular Italian sermon preached in 1306 in Florence: "Not all the arts have been found; we shall never see an end of finding them . . . indeed, they are being found all the time. It is not twenty years since the art of making eyeglasses was discovered . . . I myself met the man who invented and made them, and I talked with him."

Astronomers and physicians who had to cast astrological horoscopes of their patients felt a need for a timekeeper more accurate than the water clock. An unworkable magnetic clock was proposed. Then Robert the Englishman pointed out that the solution was a weight-driven clock, admitting that certain bugs had to be eliminated. Technicians labored over the problem until, at last, around 1330, the mechanical clock emerged. The elegant solutions to the problems of the mechanical clock make it perhaps the triumph of the age, and the harbinger of a new era of instrument-making skill.

Slow evolution of the fiddle bow

One interesting aspect of medieval inventiveness was the European ability to take germinal ideas from alien and distant cultures, and develop them in novel ways. In music, for example, the fiddle bow was invented in Java about the time Borobudur was built. The Javanese themselves paid little attention to it; their music is still percussive. The bow was diffused through Islam and reached Christian Spain about 980. At that time it was shaped like the weapon from which it took its name. This meant that as the bowstring was drawn over the strings of the instrument, tension varied and the tone wobbled. By the 12th century the French were flattening the bow's back to secure an even tension and also were developing the "nut" or "frog" to help tighten the string. Increasingly a smooth tone was produced. By the late Middle Ages—to judge by pictures—bowed instruments were vastly popular, not only in worldly orchestras but also in the celestial ensembles of angels.

The concept of perpetual motion first appeared about 1150 in the writings of the great Indian mathe-



Perpetual motion fascinated medieval engineers. This diagram shows a weighted-wheel concept.

matician Bhāskarā. By about 1200 some of his designs for perpetual-motion machines were known in Islam. The first hint of the idea in Europe is found in 1269—and thenceforth for centuries the search for perpetual motion haunted the imagination of many able Western engineers. In India perpetual motion probably expressed the basic Hindu idea of eternal return. In Islam the machines were looked on as toys that never quite worked. In the West, by contrast, they propagated the notion that nature is filled with latent forces waiting to be tapped by Man's ingenuity.

The mariner's compass reached Europe from China in the 1190s as a magnetized iron needle. Europeans rapidly provided a protective box, a pivoted needle and the compass card to approach exactitude in navigation. From the compass card there developed increasingly accurate portolan maps with straight lines to indicate the compass angles of the shortest routes between major ports or landfalls. This process culminated in 1569 with Mercator's cartographic projection.

The Indonesian blowgun reached Italy before 1425. It led not only to numerous experiments with air guns but also, by 1474 in Nuremberg, to the first industrial attempt to use compressed air to transport materials —in this case wine—from one container to another.

At about this time a Tibetan device turned up in Italy. The chief mechanical concern of Tibetan culture was with the rotation of Buddhist prayer cylinders—by hand, water, wind or any other means. In the tents of Tibetan nomads a small turbine equipped with a prayer cylinder was often placed in the central vent in the roof that let the smoke out; as the heat ascended, the turbine twirled.

In Italy, this "devout" turbine—the idea for which was probably introduced by Central Asian slaves—was fitted into a chimney and geared to a roasting spit. The machine still stands out as an elegant bit of automation: when the fire was hot, the roast turned quickly; as the fire declined, it rotated more slowly. Indeed, this Italian elaboration of the Tibetan turbine comes very close to robotism, our most recent state of automation, because the spit detected by itself changes in its environment and, without human intervention, altered the way in which it did its task.

Although Western Europeans had come to see invention as a process of value to society, no society, no "movement," ever conceived an invention. So before modern times, the inventive individual mind at work can only rarely be observed. The invention of the parachute offers a fortunate exception.

The British Library holds a manuscript sketchbook from the late 1470s and early 1480s of an engineer who probably lived in Siena. On one of its pages a man is shown jumping from a considerable height, his descent braked only by two large, fluttering, cloth streamers attached to his belt (p. 120). He holds a sponge between his teeth to protect his jaws from the shock of landing. He looks frightened. He should be.

The next pages of this manuscript are filled with hoists for careening ships, military machines, a variety of items. But clearly our engineer-sketcher remains worried about that man jumping; something better must be devised for him. So, after 21 pages, the same jumper reappears, now in a more confident mood. The sponge in his teeth is strapped around his head so that

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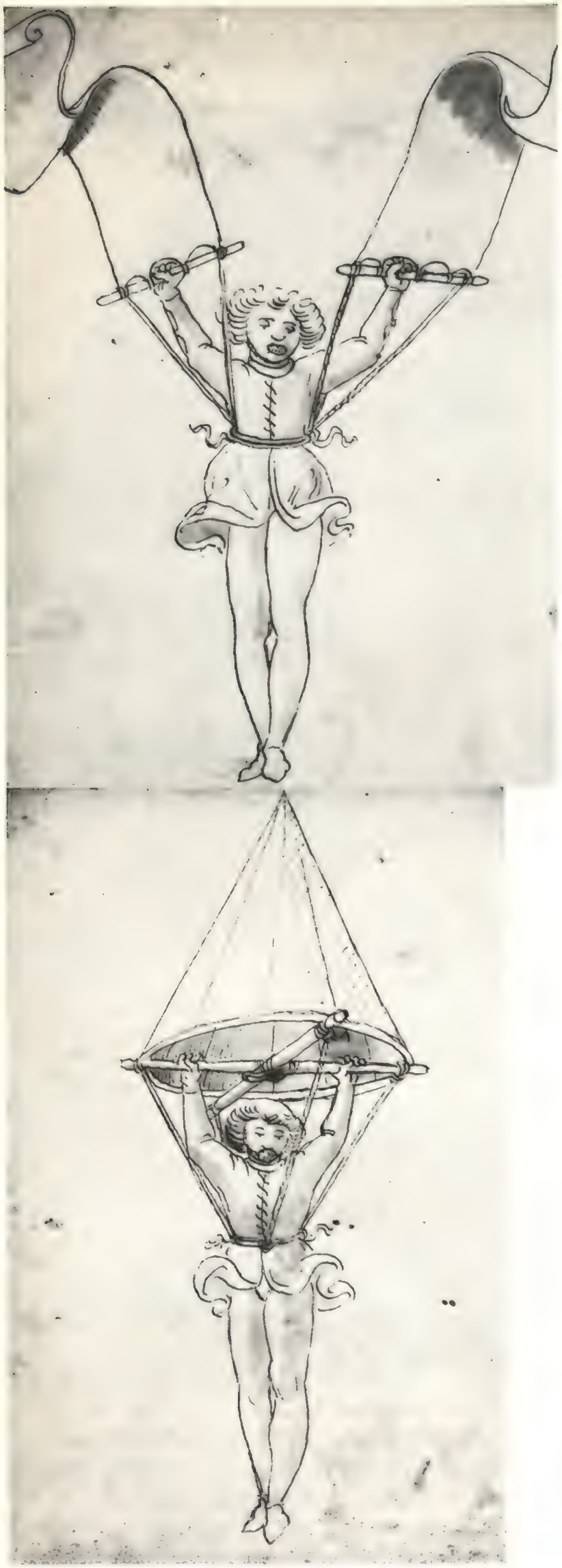

Evolution of parachute is illustrated in sketches. Top: a distraught jumper tries to slow his fall with flapping sheets. Bottom: the artist has a better idea, and the parachutist glides smugly to Earth.

if he cries out in terror he will not lose it. More important, the streamers have been replaced by a conical parachute, probably the world's first.

Slightly later, Leonardo da Vinci sketched a pyramidal parachute: the idea, if not the thing, had taken form. The true parachute reached publication in 1615-1616 in the *New Machines* of Faustus Verantius, a Hungarian bishop. After that, every engineer knew of its possibility; the trouble was that there were no specific situations in which one was needed. Only after the French Montgolfier brothers invented the hot-air balloon in 1783 (SMITHSONIAN, September 1970) did the parachute find a function. The first actual jump was made in that year. Our anonymous Sienese engineer had created a concept which lay dormant, although known, for some 300 years before being applied.

Medieval technologists showed great skill in elaborating on ideas borrowed from other cultures as well as opening up novel and currently useful engineering concepts. But also, at times, they planted seeds that could only sprout in more modern times.

How can we account for the range and dynamism of medieval inventiveness? Nothing so historically important happens for a single reason, but rather for various interconnected reasons. For one, deep in prehistory, the Near Eastern style of agriculture was introduced to all of Europe. Its chief tool, the scratch plow, was drawn by two oxen. Since it did not turn over the sod, cross-plowing was necessary to pulverize the soil and, in the Near East, to reduce evaporation. The resulting field shapes were squarish, and usually walled or hedged. In most of Mediterranean Europe, which shared light soils and a semiarid climate with the Near East, production by these simple means was fairly satisfactory.

New plow equals new society

North of the Loire and the Alps, however, the richest soils were sticky clays and the climate was so wet that field drainage was essential. Scratch-plow agriculture could not cope well with this environment. In the early sixth century, a new, basic tool was invented: a heavy-wheeled plow with a knife to cut the line of a furrow, a share to slice under the sod and a moldboard to turn over the ribbon of loosened earth. Two oxen could not pull such a machine; eight were normally used. Arable land was now plowed in strips, and all the community's strips were included in large, open fields fenced as a unit.

At first most villages had two such fields rotating in crops or fallow. By about 800, in regions of rich soil, three-field rotation was being adopted, one field planted in the autumn, one in the spring and the third left fallow. Where the novel spring planting

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provided a surplus of oats, the peasants eventually substituted the swifter horse for the plodding ox as their chief farm animal. This speeded the transition to a totally new North European agrarian system capable of exploiting the most productive heavy soils and, by plowing strips in ridges, of draining surplus water from soggy fields. We can reasonably estimate that, under ideal conditions, the shift from the two- to the three-field system, and from ox to horse, increased productivity per peasant by some 200 percent.

The agricultural revolution also had a profound psychological impact. In the era of the scratch plow drawn by two oxen, land was held by peasants in units designed to support a single family; the assumption was subsistence farming. When the new heavy plow was adopted, no single peasant could afford the eight oxen to pull it; therefore a group of peasants pooled their draft animals and distributed the plowed strips in proportion to their contributions. Formerly, Man had been part of nature. Now Man was drawing an income that was proportional to the labor and capital that he invested in exploiting nature. Man and nature became two different things, and Man felt himself to be dominant.

This sense of dominance was enhanced in Christianity. Greco-Roman pagans had believed in a hierarchy of spirits, from the quarreling gods of Olympus to the spirits of rocks, trees, springs and the like. Keeping these unpredictable entities placated was a perpetual task. Christianity, following its mother religion, Judaism, eliminated spirits from the objects of nature. Christian Europeans could manipulate nature without qualms and according to their wishes. God, the Latin Church taught, had created the visible world for mankind's use and instruction, and for no other purpose. The new plow and the new religion offered to the working people of the early Middle Ages an atmosphere cordial to technological innovation.

From about the sixth century before Christ, the upper classes of the ancient world had held in contempt anyone—enslaved or free—who worked with his hands. The exception to this attitude was found among the Jews. Rabbis taught that Yahweh had commanded his people to work six days and to rest on the seventh; that the duty to work was as important as the duty to rest. The rabbis themselves often worked as craftsmen.

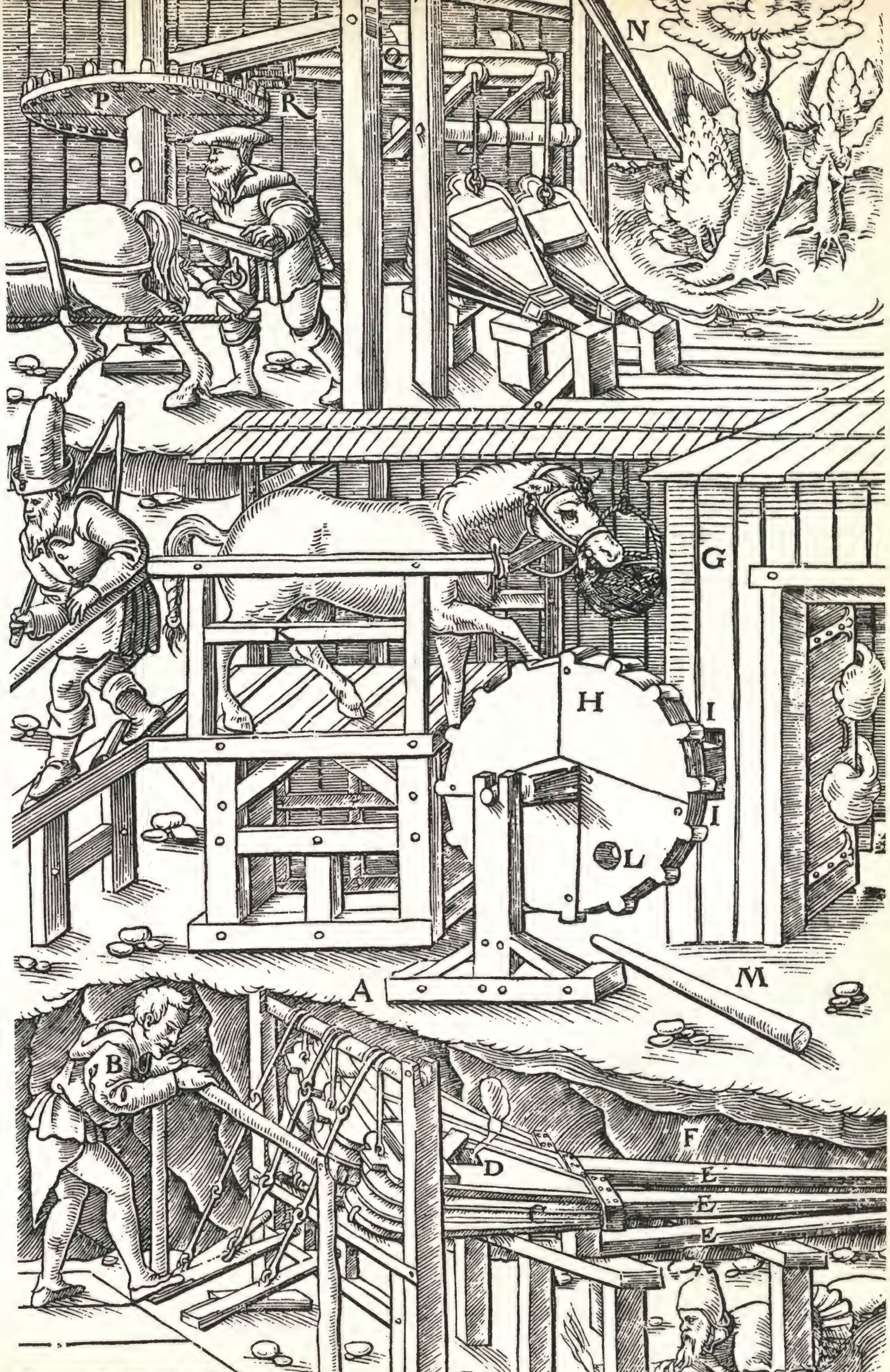
In the late third century after Christ, pagans poured into the Church too rapidly to be properly indoctrinated, and Christian rigorists felt that to battle corrupting influences they must return to the days of the primitive Church—that is, to the pattern of life when Christianity was still essentially Jewish. The result was monasticism, with its rabbinical insistence that work is worship.

The early Middle Ages in the West are often called the "Benedictine Age" because of the great prestige of the working monks. In the 13th century both Franciscans and Dominicans developed adjunct "tertiary" orders of devout laymen who tried to live holy lives not in convents but rather in their families, communities and vocations. The potential sanctity of lay life began to be realized, including the work ethic. Unless labor, especially manual labor, is to some extent respected in a society, technology will not thrive.

The famous *Utrecht Psalter*, illuminated near Rheims about 830, contains a picture showing preparation for battle between the forces of good and evil. At the left—the *sinister* side—is assembled a considerable troop of the Ungodly. At the right stands an alarmingly small cluster of the Righteous led by the Psalmist, King David. God's hand blesses David from a cloud, while a protective angel hovers nervously over him. The picture focuses on the sharpening of two large swords, one in each camp. The Ungodly are using an old-fashioned flat whetstone. The Righteous are using the first firmly datable rotary whetstone, twirled by the first crank found outside China.

The monk who made that remarkable drawing was saying emphatically that technological advance is part of God's moral expectation of mankind. This conviction has continued unbroken almost to our own time. It is the reason why the medieval and modern West has poured such devotion, intelligence and capital into technological inventiveness.

Three ways of forcing air into a mine for ventilation appear in woodcut from *On Metallurgy* (an early treatise) showing how, on different levels, horse- and manpower activate machines to pump bellows.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By Michael Olmert

They can persuade an ailing hippo to sound its *ah-hh*

Bones are set, plagues cured and diets improved as doctors at the National Zoo work to conserve, breed rare species

Making a far-flung house call to a docile patient takes Dr. Mitchell Bush to the zoo's breeding center

Meet Dr. Bush. He's making a house call on a pediatric patient, a one-month-old youngster with a pronounced knot on its forehead. The doctor stoops over his tiny, anxious charge:

"When did the lump appear?"

"Today," replies a chorus of worried voices.

A pause.

"Has he been eating?"

"Yes, fine."

"Any strange behavior?"

"None."

Another pause.

"Well, it's sinusitis. I'll have to open him up and drain the infection. If he were staying here, we could just watch the lump and see if it goes away. But we can't. Put him out in the wilds like that and the other birds will peck at him. Grab his talons and let's get to work. Be careful of those wings, they're really brittle."

Wilds? Wings? Talons? Indeed. We are in the Bird House at Smithsonian's National Zoological Park in Washington, where Mitchell Bush, 37, is a doctor of veterinary medicine and the head clinician, with a support staff of seven. He runs a sophisticated medical program with X-ray diagnoses, emergency surgery, individualized diets, computerized records—all the accouterments of modern urban health care. Zoos are no longer considered to be large-scale pet shops (SMITHSONIAN, March 1978). They are life-support labs where the mysteries of survival are probed. The emphasis is on rare and endangered species—how to breed them, how to make and keep them healthy—with the hope of someday reintroducing them to the wilds.

Today Bush's patient is a bald eagle chick, only the second hatched at the zoo, and one that will be returned to an Ohio wildlife sanctuary to grow up and raise its own family.

Bush is the Jean Hersholt—the kindly movie-radio Dr. Christian—of a small town of 3,500 residents. He's overworked, just like his prototype, but there is a difference: his 3,500 potential patients range in size from elephants and giraffes to the Egyptian spiney mouse, a tiny fuzzball you can hold in your fist.

Bush has an appealing way of calming and gentling animals before an examination or a surgical procedure. At the zoo's hospital you can catch him in the superfluous act of smoothing the feathers of an anesthetized emu (p. 130) or stroking a dead-to-the-world turtle while he waits for a nurse and technicians to ready the next stages of an operation.

Days are long for a zoo vet. Each morning he arrives at the hospital at about 7:30, checks his patients (there are usually five to ten animals in the wards), then

in rural Virginia. From his office in northwest Washington, he drove 70 miles for this Bactrian camel.

settles his 6-foot-3-inch frame into his smallish office to scan the medical literature. In the dim light, the great books of his profession are at arm's reach on all sides: *Canine Neurology, Diseases of Cattle, Physiology and Biochemistry of the Domestic Fowl.* The white glow of an X-ray viewer permeates the clutter.

On a coatrack are two Irish fisherman's hats. Bush never goes much of anyplace without one—he would probably wear one in surgery if it would not be a gross violation of sterile procedures.

Suddenly he is up, grabs a hat, and is off on his rounds. He rallies an intern and a veterinary student, and they load their van with three enormous cases full of immobilizing agents, instruments and medicines.

First stop, the Bird House, to check on the progress of the eaglet. Its head is healing well, no complications. The doctor orders antiseptic on the wound, a germicidal ointment for the eye close to the infected sinus, an antibiotic injection and a blood sample. A blood sample? "We're a teaching facility as well as a preventive medicine and clinical veterinary operation," says Bush. "And this business of zoo medicine is a new one. For most of the world's exotic animals there is little dependable information on how their physiology works. Yesterday I gave this bird an antibiotic. Today I want to note and record how much of it he's burned off. A look at his blood will tell me."

Bush and his associates have discovered that the medicine dosage you give an exotic animal does not necessarily depend on the animal's weight or its similarity to humans or to domestic stock. The antibiotic gentamicin, for example, has a half-life (the time it takes for half the dosage to disappear) of 20 minutes in birds, up to four hours in mammals, and as much as 80 hours in reptiles. This is an important finding. Many snakes have been killed by gout and eventual kidney failure from overmedication with antibiotics. Had this information been available earlier, those reptiles could have been saved.

Next stop, the Elephant House, to check a pigmy hippo with a dental complaint. For this patient life has been easy only since its arrival at the zoo, when Bush noticed that its lower jaw did not look quite right. X rays showed gunshot pellets and fracture callus, probably from a traumatic encounter with poachers. It suffers a severe malocclusion that prevents its tusks from wearing down naturally. The doctor's job: to clip back the new tusk growth each year. Bush rules out any genetic basis for the problem. The hippo has fathered about 30 offspring; none has needed braces.

Then to the Lion House where Jude, a 150-pound jaguar, is not happy to see the doctor. Bush has been treating it for a torn footpad for weeks, and the cat is bright enough to realize that the man in the hat is somehow associated with its miseries. "That's the difference between cats and birds. The eaglet couldn't remember that I was the one who lanced his head and gave him a shot only hours before. Jude will never let me forget—either the foot surgery or the vasectomy."

Ironically, certain animals breed too readily in captivity—including jaguars—and for them and others Bush uses modern vasectomy techniques. The big cat growls and swats the air. Bush squints into the bright light of the resting enclosure. "Jude, you're doing just fine." In a nearby cage, Marvin tilts his head to see what's going on. Marvin is an enormous Bengal tiger in good health and probably regards Bush as just a friend of those wonderful folks who bring in lunch.

Here, behind the natural-habitat exhibits that the public visits, the big cats rest in their feeding dens. Surely the difference between them and *Felis catus* is a simple matter of a few genes. Their dispositions seem so good that you are tempted to run home for an electric can opener. Turn it on and they will prance

The author wrote about the 19th-century satirist J. J. Grandville in last month's SMITHSONIAN.

Photographs by Richard Swanson and Michael Olmert

over and rub against your leg. It is a reckless idea. These cats are as powerful and aggressive as they need be to survive. But zoos want them to survive longer than they do in the wild, and that requires medical treatment, which, for certain procedures, can mean temporary immobilization with drugs.

In zoo talk, the immobilization of an animal is called a "knockdown" and Bush or another staff vet performs every one. The animal's keepers and the veterinarian carefully weigh the danger of a knockdown against the threat of waiting until a disease has passed the stage where it can be cured. For some animals, the mere pressure of physical restraint—without the use of drugs—during examination or treatment can cause death. Birds can die from handling, especially if they are already weakened by disease.

Bush and his colleagues continually study the ways animals react to the stress of knockdowns and drugs. They record the blood chemistry—oxygen, carbon dioxide, and pH levels (a measure of how acidic or basic the blood is)—of every immobilized exotic animal. The result is a collection of 2,500 samples from more than 1,000 creatures. This is the beginning of a data base for zoo veterinarians around the world.

This research will also yield data on dosages of synthetic morphine derivatives. For example, a one-ton rhinoceros has been anesthetized with 1.5 mg of etorphine, while a 200-pound deer can require five times as much. With this variance, the only alternative is to keep careful records and review them before each knockdown. The animal handler who bases dosage on *weight alone* could eventually kill some animals.

Recently Bush helped move an onager, a wild ass, that had been fighting with other males in its herd at the zoo's Conservation and Research Center in Front Royal, Virginia. The knockdown instrument: a blank-cartridge-powered rifle, which fires a hypodermic dart. The dart uses a very small powder charge to squeeze the drug into the animal's muscle tissue. This was Bush's first onager, so he calculated the etorphine

Drug-bearing dart from Bush's pistol will immobilize wildebeests for health examination.

Intern Jandel Allen, a pre-med student, examines her X rays of pigeons' digestive systems with the expert.

dose from what he knew of its effects on related species, such as zebras. On foot, he got as close as necessary and fired. He was on target, but the pressure of the drug flowing from the point of the needle forced the hypodermic back out of the hide. Eighty percent of the dose ended up as a fine spray floating off with the other mists of a Virginia dawn.

Rather than load again, he waited. In just eight minutes the animal settled down, ready to be taken to its new range. "That information is now a permanent part of my file on onagers. Before I knock down another one, I'll review it."

Bush insists on collecting complete physical information on every immobilized animal. Included with blood chemistry are EKGs, X rays, TB tests, excretory samples and a physical examination. All this becomes part of a record for the species—available to zoologists worldwide and to the zoo veterinary staff the next time that particular animal gets sick.

There *are* animals that resent all this attention, especially if it means being darted with a drug. Gorillas are the most intransigent. They have learned to recognize the dart pistol that Bush uses in the confines of the Small Mammal House. When they see it, they squirm—like patients in any doctor's office. One orang went anxiety one step further. As soon as it was darted, it reached down to its flank, calmly removed the syringe and handed it back to the amazed doctor as if to say, "Mitch, you've got to be kidding."

It is one P.M. at the hospital complex. Dr. Richard Montali, head of the office of pathology, prepares for an important and little-known ritual, the daily autopsies. Montali, 39, is a veterinarian whose specialty is discovering the causes of death in zoo animals. Only two zoos in the nation have staff pathologists. The pinpoint information that Montali and his biotechnicians provide prevents many outbreaks of disease.

Last year 638 animals were given postmortem examinations. "That includes infant and old-age deaths, newly arrived animals that died while they were being quarantined, and even migratory waterfowl that dropped into the zoo for a visit and liked the food so much they stayed," Montali explains. "We want to make sure we learn the maximum from each death here." He and Bush have written many medical papers based on their two-phased—clinical and postmortem—approach to keeping the zoo population healthy. They uncovered a viral plague infection that was decimating the ducks and found that migratory black ducks were the carriers. At another zoo the entire duck, goose and swan population might have been wiped out before being vaccinated.

Today's first specimen is a muntjac, a Southeast Asian or barking deer, found dead in the relative wilds of Front Royal. It seems emaciated. The autopsy shows it has eaten very little for some time because of a badly abscessed tooth in the lower right jaw. "It probably caused so much pain that he just stopped eating. The

Bush wraps the leg of a bald eagle with gauze before he operates on it to fuse a joint.

decline follows quickly—terminal nutritional crisis."

The second examination is of a cinnamon teal, a river bird. It looks healthy, but X rays and autopsy show a broken wing and internal hemorrhages.

"It was clearly attacked, likely by another bird, but why?" asks Montali. "There is almost always an underlying cause. The individuals already vulnerable because of disease, or because they're slow or weak—those are the ones sacrificed by nature to make a better breeding stock. But, look what I found in this gizzard: three sequins from a lady's hat!"

To make sure that everything possible is learned from these animals, small sections of each specimen's brain, internal organs and muscle tissue are preserved in formalin for pathologic study. In a cooperative program with George Washington University, the preserved tissues of large cats are being surveyed for lead. Since cats constantly lick their fur, they are bellwethers for unacceptable amounts of lead pollutants in urban air. Cats long dead can tell us whether the problem is getting better or worse.

All the zoo's medical data from autopsies, knockdowns, routine health examinations, surgical procedures, medication dosages and other studies are quickly available to the staff through computerized files. Every animal has an accession number, just like an object in a museum, and keeps it from day of arrival until day of autopsy. Researchers can cross-check the files for similar diseases, symptoms or complications, regardless of species. These records are regularly consulted by zoo professionals here and abroad.

Bush returns from an after-lunch run in the park to find a new patient waiting in the emergency room: a month-old kitten, the only offspring of a leopard cat. It has been limping ever since its mother dropped it from her tree perch. The X rays show a broken leg ("right hind leg, transverse fracture of the fe-

Anesthetized baby leopard cat breathes into a rubber-glove "bag" while its broken leg is set.

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In the hospital's prep room, veterinary student Debra Beasley helps Bush mend a lame emu.

mur"). Bush: "The mother will chew off any cast I set the leg with, or else she'll refuse to feed him. I'll have to pin the leg."

Quickly the operating room is readied. Nurse and intern stand by. Bush wraps the kitten in a towel and carries his outraged patient into the prep room to be weighed and anesthetized. Four minutes after its injection, the kitten is in twilight—breathing regularly, eyes wide open—and can be handled. The broken leg is shaved. Prominent markings in the fur are still visible in the hair follicles.

Nurse, intern, doctor and patient move into the sterile surgery room. Caps, gowns, face masks and rubber gloves all around. The kitten is draped and given a breathing tube. The patient is so small that not even the tiniest pediatric breathing bag will register the little puffs of air it exhales. The solution: rig a surgical glove to the oxygen apparatus (p. 128). During the operation, a pale yellow hand—a rubber one—flexes in unison with the kitten's lungs.

After scrub-up, Bush begins. An accurate incision means swift location of the fracture site. He shifts the bone and inserts a pin through the break, then moves the leg to make sure the pin is set. The wound is sutured, the kitten is returned to its hospital cage. Elapsed time for the operation: 45 minutes. In six to eight weeks, Bush will remove the pin and this leopard cat will be fine. In the wild, its mother might have shunned it because it was lame; it would have died.

Orthopedic work is a specialty for Bush. He once repaired a timber wolf's broken leg by using a bone graft from its seventh rib. He mended the leg bone of a red-tailed hawk with a complicated half-pin splint. X rays, he explains, can pinpoint the problem and suggest a solution, but there are times when they can be enigmatic. Take the day the zoo's Madagascar day geckos, Kelly-green lizards with brilliant red markings, were brought to the hospital in an obvious decline. The first X rays showed only faint skeletons. Another set was ordered. Physical examination showed the geckos had pliable, rubbery bones. Diagnosis: nutritional deficiency. Not enough calcium. Other evidence pointed to a lack of vitamin D.

How did this happen? Geckos eat crickets exclusively at the zoo and get plenty of them. But crickets are low in calcium and don't supply vitamin D. What to do? The theory is that in the jungle a gecko gets its vitamin D and calcium from small rodents, birds and whatever the crickets have recently eaten. Some of that meal is still in the cricket's stomach when it, in turn, becomes a gecko's meal. Since zoo crickets eat only sweet potatoes, the answer is to feed crickets milk powder (for calcium). And for vitamin D, the gecko's skin, like ours, manufactures it from sunlight. An ultraviolet light in their habitat does the trick.

When food is the problem, the man called is Dr. Olav Oftedal, 28, the only zoo nutritionist in the nation. A specialist in evolutional biology, he spends his days analyzing animal diets and their shortcomings.

"Animals are like people—they eat too much of the things they like. Primates love fruit and will eat it all day, but it leaves them with a protein deficiency. Rodents love peanuts and sunflower seeds, which give good energy and protein but no calcium.

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"In the early history of zoos, keepers just watched what the animals seemed to like and then pushed those treats. I suspect that most zoo mortality has been related to diet. There's probably no more important area for preventive medicine."

He is looking for dietary ways to slow the captive growth of emus and other running birds so their body weight does not overburden their leg tendons.

To the tradition of feeding baby eagles ground meat, Oftedal says no. He reasons that wild chicks would first be fed strips of fish, then whole fish, giving them bones for calcium, and liver and kidneys for other nutrients. So the zoo's chick is fed meat laced with cod liver and wheat germ oils, calcium and vitamins. "I'm sure that the meat-only diet has always been the culprit in raising eagles," says Oftedal.

The fight goes on for species preservation. Bush is perfecting his use of the laparoscope (for "Band-Aid" surgery) to take biopsies and study reproductive cycles. Montali looks at reindeer genetics with an eye to their immune response system. Extinction of certain animals, it turns out, is not so much a result of overkill by Man as of his destruction of their habitats. When suitable habitats are established or reestablished, the zoo doctors want to be ready to help populate them with new generations of wild creatures.

Nestled within the warm security of Dr. Bush's hand, a newborn golden marmoset, battered by its own mother, awaits medical care. If it recovers, it will be hand-raised by zoo staff, and may survive.

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By Timothy Green

Photographs by the Gibson family

Sea catastrophes are their business

Mr. Green's most recent article for SMITHSONIAN, *in May 1978, dealt with the cleanup of the River Thames. He is a London-based journalist.*

For more than a century, four generations of a Cornwall family have photographed the vessels shattered upon their fierce coast

Shipwrecks have a compelling, if macabre, fascination —especially for those who have grown up within sight and sound of the sea. The first flare of a distress rocket in a storm is enough to set a whole community rushing to beach or clifftop, to get a rescue boat afloat or haul lifesaving gear to some remote promontory.

Nowhere is this more true than in the western approaches to the English Channel, where the rocky Isles of Scilly and the towering cliffs of Cornwall have for centuries snared ships driven before Atlantic gales.

For the last 100 years few men can have been lured to those wrecks so often as the four generations of the Gibson family, all photographers in the Cornish town of Penzance and out at St. Mary's on the Scilly Isles. From John Gibson, who started taking photographs in the late 1860s to his great-grandson Francis (Frank) Gibson, who still responds to any shipwreck alert today, coverage of disaster at sea has amounted almost to a family obsession.

For a long while no one fully realized what a remarkable portfolio of heroism and tragedy was gathering dust in a shed behind Frank Gibson's photographic shop at St. Mary's. Hundreds upon hundreds of old photographic glass plates lay there. Then a British solicitor turned underwater explorer, Rex Cowan, started searching for clues to the exact whereabouts of various wrecks. In Cornwall he found the Gibsons' archive of shipwreck pictures and the result is Cowan's book, *Castaway & Wrecked,* produced with the considerable aid of Frank. It not only presents some of this

Steamer *Castleford* ran on one of the Scillies in 1887 with a cargo including 460 head of

Three of the Gibson generations appear in these photographs. From left: eccentric Alexander, his brother Herbert, both John's sons; James, born in 1900; and his son Francis, born in 1929.

cattle. Herbert Gibson caught her nuzzling the rocks. Her crew was saved; 400 bullocks lost.

historic collection but for the first time marries the pictures with vivid accounts of the disasters from contemporary Cornish newspapers.

When John Gibson, and later his sons, Alexander and Herbert, started their photography profession in the Victorian age, most newspapers were not equipped to reproduce photographs regularly or speedily. Reporters then set out to capture the wrecks in the printed word for the local press.

Thus in *Castaway & Wrecked* we see not only the Gibson pictures of the Norwegian bark *Petrellen* hard aground in a froth of surf, and the Penzance lifeboat dashing out to her aid, but we can read the tale as the *Royal Cornwall Gazette* reported it in February 1885: ". . . about 7 a.m. flambeaux were burnt to signal that she was in distress. The coastguard at Penzance responded by throwing out rockets, and the lifeboat crew launched their boat with much smartness, and in a short time were making for the barque. By this time

Minnehaha (top) struck hard in January gale in 1874 and ten drowned. *Khyber* (below) sank 31 years later, losing 23. Alexander painted the scene, then photographed painting.

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hundreds of people had assembled on the pier. . . ."

Among them were John Gibson, and probably his sons, Alexander and Herbert, struggling with their cumbersome tripod and camera. They watched as the captain and mate "persistently refused to leave the ship, notwithstanding the imminent peril in which she lay."

By then John Gibson was an old hand at covering wrecks. Originally a seafarer himself, he had retired to run the general store at St. Mary's and it was there he took up photography as a sideline. One of his early pictures was of the three-masted *Minnehaha* which struck a rock off the Scillies one January night in 1874. The crew took to the rigging but, driven by the cold, then tried to swim for the shore in the darkness. Ten perished. When Gibson got there the next day, after the survivors had staggered to a lonely farmhouse to raise the alarm, the ship was already breaking up fast. His slightly hazy picture (p. 136) captures the terrible beauty of a sailing ship in her death throes.

Besides shooting pictures and minding his store, John Gibson was also the first telegrapher on the Isles of Scilly. It was he who sent the outside world news of each latest wreck. But life on the islands was hard, and eventually the family moved to Penzance on the main-

Battered apart by surf, the hulk of Austrian bark *Cviet* rests on the beach where she

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plowed ashore in a southwest gale in 1884 with a loss of three lives. Alexander caught the scene.

land. They always kept a house at St. Mary's, however, and went back every summer to cater to the budding tourist trade.

Vintage years for Gibson shipwreck photographs were between 1880 and 1900, as Alexander and Herbert reached their prime. "There were three or four wrecks every year then," recalls Frank Gibson. "All the grain ships were coming in from Australia and they often got into trouble."

The Gibsons caught the full fury of waves beating over the Austrian bark *Cviet* (at left) which came ashore near the Lizard on a January afternoon in 1884. Unfortunately they arrived too late to capture the heroism of a local fisherman who had plunged through the waves with a rope around his waist to take a line out to the vessel. As the *Western Morning News* reported, "At times, when he was going towards the ship, the waves took him off his legs, and for nearly a minute he would disappear beneath the seething waters, so that . . . the bystanders thought he would be drowned. But, nothing daunted, when he came to the surface he persevered, and did not come back until he had effected a communication between the ship and the shore." Eight of the 11-man crew were saved.

Alexander Gibson, by all accounts a formidable and

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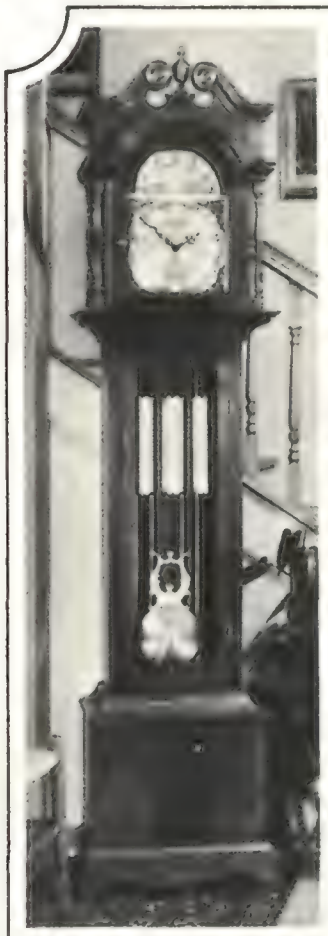

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eccentric fellow, was not always put out if he missed the moment of high drama. He simply re-created it in his own watercolors, which he then photographed.

One of his more sensational paintings (which actually has much of the quality of an old daguerreotype) was of the three-masted *Khyber* being battered beneath the cliffs of Land's End. Gibson arrived to find the British ship no more than a pile of pulverized timbers on the beach and 23 of her crew dead. He photographed the wreckage from all angles, then got hold of a lad who had miraculously survived and took him to his studio to pose before an artificial seascape. Alexander completed coverage with the painting (p.136).

Alexander was the center of several family feuds. After one set-to with his son James about the future of the photography collection, he dumped all the shipwreck plates into a carrier's cart bound for James' house. He retained the archives of the daily portrait business. The transfer was fortunate, for some time later Alexander, in a fit of rage, threw the rest of the collection down the shaft of a deserted tin mine. The pictures have never been recovered.

The Gibsons' speedy response to any distress call sometimes paid off with real journalistic scoops. When the steamer *City of Cardiff* drove on the rocks of Mill Bay, near Land's End, in March 1912, either Alexander or Herbert (the surviving plates often give no clue as to which Gibson actually pressed the shutter) was on hand as the Sennen lifesaving team struggled to set up their gear on an 80-foot cliff high above the grounded vessel. A rocket line snaked out to the ship. Presently, one by one, all 26 persons aboard, including the chief officer's wife and young son, were hauled through the surf and up the cliff by breeches bouy. The camera first caught a survivor poised perilously in mid-air between ship and shore, then focused in on the tense faces of rescuers perched on the clifftop (p. 141).

The worst disaster the Gibsons covered was the wreck of the liner *Mohegan,* which went off course in a calm sea near the Lizard in October 1898 and ripped out her bottom. Death toll: 97 passengers and crew.

By the time the Gibsons got there, all that could be seen of the ship was her funnel and masts (below). But on shore they photographed local villagers staring stunned at the bodies of children brought from the beaches where they had been washed up, the pile of coffins in the village and the great open grave.

The Gibsons were on hand to record the end of one of the world's most remarkable ships, the American *Thomas W. Lawson,* the only seven-masted schooner ever built. An unwieldy 5,000-tonner, she had been a bad luck vessel from the start, and on her first open-ocean voyage in December 1907 she ended on the rocks off Scilly in a fierce gale, losing 17 men and 60,000 barrels of oil.

In the 1930s the Gibson clan returned permanently to the Isles of Scilly, but the last of the Gibson photog-

Liner *Mohegan* went off course in 1898 and struck the Manacles, south of Falmouth. She sank bow

raphers, James and his son Frank (who now runs the family business), have not had to focus on comparable human tragedy. "In my lifetime there have been only two or three major wrecks," Frank said. "And they are less photogenic. Those old sailing ships were beautiful in themselves. When I went to photograph the *Torrey Canyon* [the giant oil tanker that went aground between Land's End and the Scillies in March 1967] it was just a great hulk sitting there."

Frank finds beauty, instead, in photographing raging winter seas or the sparkling elegance of fine yachts that pass Bishop's Rock Lighthouse in summer. "Living on an island," he says, "my life is bound up with the sea."

Nowadays most distress calls are for small yachts in trouble, but Frank is always alert for any alarm. A couple of winters ago when a French trawler was wrecked on the islands, he chartered a boat to go out and photograph the scene. And he has a shortwave radio at home to keep in touch with the St. Mary's lifeboat every time it puts to sea.

Sennen lifesavers reach for a crewman from the stricken *City of Cardiff* as he rides a breeches buoy.

first, and Alexander Gibson photographed
masts and funnel, silent memorials to 97 lost souls.

The "Pink City" sprawls beneath Hawa Mahal (background) and barren neighboring hills.

By Madhur Jaffrey

Jaipur, a showcase city of Indian rule survives democracy

It's now aged 250, and its maharaja flies a kite. But regal elephants still amble past pink facades, and old crafts flourish

Jaipur girl carries water vessel past Hawa Mahal, from which court ladies, unseen, viewed processions.

It was Makar Sankranti day, and everyone in the Indian city of Jaipur was flying kites. The gentle man who had once been installed as the Maharaja of Jaipur was sipping fresh tomato juice and flying his deep blue kite from a gracious, manicured lawn. The grimy, ten-year-old urchin who worked for his father's tie-and-dye business was munching roasted chickpeas and flying his yellow kite from the rooftop of his family home.

It has been the custom in Jaipur that the day on which the sun enters Capricorn, everyone—rich and poor—helps to fill the clear winter sky with a kaleidoscopic spectacle. It is not considered enough to get the kites to soar and swoop and dip and loop at will. Each kite, its string carefully rubbed with rice glue, egg white and ground glass, is sent to do battle. Bets are placed on these paper warriors. As they zoom and tangle, loudspeakers blare taunts and victory whoops.

Kite flying on Makar Sankranti is one tradition that has survived in Jaipur. For the city is changing, slowly and often reluctantly, from the fortified seat of a wealthy, feudalistic monarchy to one of democratic India's many sprawling state capitals.

Photographs by T. S. Satyan

Royal City of Jaipur

Jaipur used to be known as India's royal "Pink City." Today, as it celebrates the 250th year of its founding, it is neither royal nor as pink as it once was. India's royalty—its jewel-encrusted maharajas, rajas and nawabs who held sway in semi-independent kingdoms—are gone. Thus the pink color of Jaipur's inner city, derived mostly from the annual wash given its buildings at the command of its ruler, has changed toward apricot under democratic bureaucracy.

Yet camels still shuffle through arched gateways and elephants still march in processions, carrying not princes but camera-toting tourists, four to a howdah. Moreover, most of the city's royal palaces and forts are now hotels, museums and national historic sites.

The city sits on the periphery of the Rajasthan Desert, about 150 miles west of Agra. Rugged brown hills and hillocks, crowned with sturdy fortresses, protect it on three sides. When the Moslem Moguls overpowered North India in the 16th century and established capitals in Delhi and Agra, the proud Kachhwaha Rajput rulers of this region acknowledged Mogul suzerainty, shrewdly gave the Mogul emperors their Hindu daughters in marriage and loyally led Mogul armies to victories throughout India. For this they were amply rewarded.

By the start of the 18th century the Mogul empire was crumbling. The maharaja of the Kachhwahas was then Sawai Jai Singh II (the title "Sawai"—one and a quarter—indicated that the holder was worth more than one man alone), a man famed for his abilities as a general, mathematician and scientist. Jai Singh began enlarging and consolidating his kingdom and in 1728 laid the foundations of a city, Sawai Jaipur.

Miss Jaffrey's most recent contribution was about the Ajanta Caves, August 1976. India-born, she is an award-winning actress as well as a writer.

This 23-foot oil of the Prince of Wales entering Jaipur on elephant in 1876 was painted by Russian artist Vassili Vereschagin. It came to maharaja from the U.S.

Victoria Memorial, Calcutta

Miniature painting shows an elephant fight raging for the delight of Jaipur's royalty, who wagered extravagantly on the outcome.

City Palace Museum, Jaipur

The city was to be built on a grid plan with streets running north-south and east-west, bisecting each other at regulated intervals. Some streets would be as wide as 111 feet to accommodate royal processions that included Jai Singh's double-storied, two-elephant chariot. Others would be narrow lanes, shaded from the searing summer sun by multiple-storied houses on either side. One-seventh of the city area was to be reserved for the palace and its grounds.

Though the plan for Jaipur was supposed to have been based on ancient Hindu texts, there were no other cities like it in India. (About 150 years later when Rudyard Kipling wandered through Jaipur, he was struck by the similarity of its general plan to American cities he had seen. He concluded that "the good people of America builded their towns after this pattern but, knowing nothing of Jey Singh, they took all the credit to themselves.")

The entire city, about two-and-a-quarter miles long and about one-and-a-quarter miles wide, was enclosed by a crenellated stone wall, 20 feet high and nine feet thick. The seven fortified gateways in the wall were shut at night to keep out tigers, panthers, bears, wild boars and the enemy.

Inside, Jai Singh wanted an integrated community of feudal lords, administrators, skilled artists and craftsmen. These latter were encouraged to settle down neatly, grouping themselves according to profession: gem cutters in one lane, gem setters in another, tie-dye workers, gold enamelers, stone carvers, bangle makers, damascene workers, pearl salesmen, wood carvers, cloth printers, shoemakers, brass engravers and blacksmiths all in their special areas.

"Millinery of masonry"

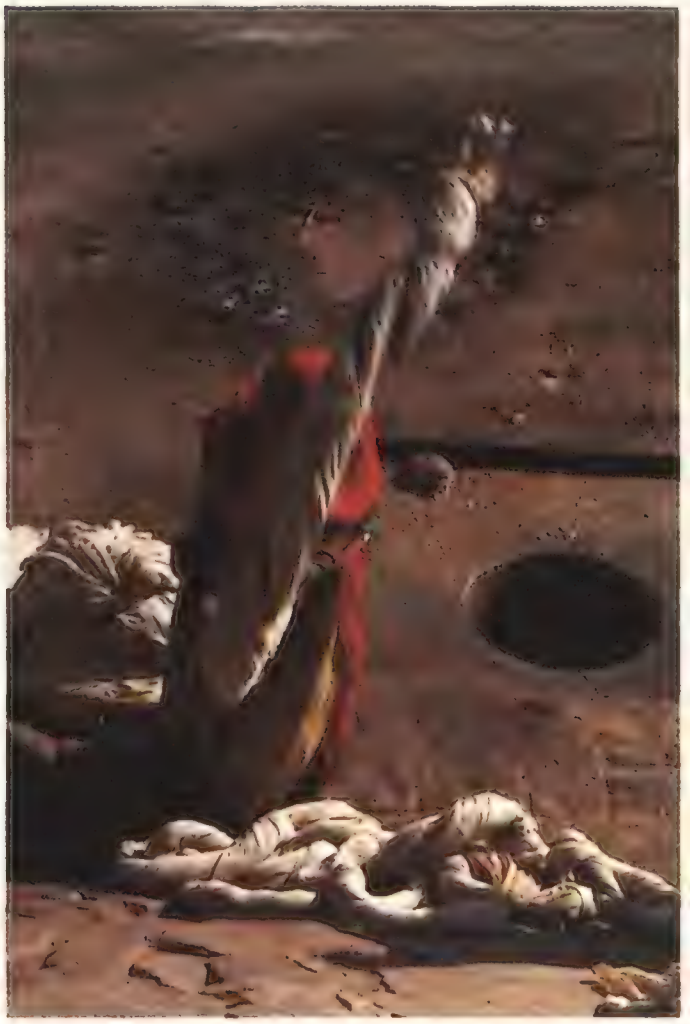
Jai Singh's palace, the seven-floor Chandra Mahal, was set in a large enclosure that included fruit groves, terraces, tanks, formal gardens, temples and an observatory containing enormous masonry instruments famed for their accuracy. Some walls in the palace were "entirely composed of small looking-glasses, in fantastic frames of chunam [lime] mixed with talc." Everywhere there were lattice screens so finely cut out of stone that they were described as the "millinery of masonry." Men admired their fine tracery; women stood behind them and admired the men.

By 1818, the Moguls had been reduced to becoming puppets of British East India Company. The house of Jaipur, fairly independent now but beset with marauding neighbors, accepted British supremacy. During the Sepoy Rebellion, Jaipur rulers sided with the victorious English and were once more rewarded.

Jaipur state, with Jaipur City as its capital, prospered anew. Princes and feudal lords hunted tigers,

A Jaipur lad stirs up a vat of water where block-printed cloth is being boiled to fix dyes.

Skilled local artist paints Jaipur's blue pottery. He revived the old craft, but uses molds for most work.



Woman whacks twist of cloth on ground to remove moisture after it has soaked in background color.

black bucks, panthers and wild boars. In the evenings, nobles leaned back against cushions on soft-mattressed floors sucking homemade *aasha* from the tiny mouths of fanciful bird-shaped vermeil goblets. As the jaggery-based alcoholic beverage mellowed the mind, venison *soole kababs* were passed around to titilate the palate. There were dancing girls, too, and performers who could twist their bodies like rope.

There were elephant fights. For several months in advance, two unsuspecting pachyderms were fed a steady diet of butter and sugar in order to get them to the required state of arousal. Then they were let loose in an enclosure. Foreheads crashed, tusks rattled, huge hulks trembled. The cheering gentry placed bets.

Over the years, Jai Singh's palace was remodeled many times, acquiring new wings, apartments and edifices including the multistoried Hawa Mahal, or Palace of the Winds, with delicately filigreed, projecting bays that rise skyward in a pyramidal form. The palace complex (today's "City Palace") resembled a jigsaw puzzle of rooms, gateways, courtyards, halls.

Then Jaipur rulers began copying British ways. Damask couches were placed in freshly gilded rooms. Italian painters were invited to cover palace walls with floral designs. Wrought-iron pillars held up new porches in old courtyards. The city was lit with coronet-topped, wrought-iron gas lamps. Each lamp had on it the monogram of the maharaja (Sawai Ram Singh II), artfully designed to look like the V. R. of Queen Victoria. Brass bands played English tunes in the garden.

Just before the Prince of Wales (later Edward VII) visited Jaipur in 1876, the entire city was painted pink for the first time. "Rose-colored houses, picked out in white" and shop fronts shaded with red-and-white striped awnings inspired the correspondent of the London *Times,* who accompanied the Prince, to describe Jaipur as a city composed of "solid strawberry creams streaked in white arabesque."

In 1902, Sawai Madho Singh II decided to attend the coronation of Edward VII. But no Jaipur ruler had crossed the "black waters," thus losing caste and incurring the wrath of the gods. And how could a direct descendant of Rama eat suspicious foreign foods? So it was decided that the gods would travel with the maharaja in special temples aboard the ship, blessing the food to render it edible. The sea would be propitiated with offerings of pearls, silks, as well as gold and silver vessels. Since the gods could not live on a ship where meat and wine had previously been consumed, an entirely new Pacific and Orient liner was hired and

Eighteenth-century brass door with sealed locks guards Chandra Mahal, seven-floor palace of Jai Singh II, Jaipur's planner. His street grid was an innovation in 1727. Cities in U.S. Midwest used a similar system.

Red-turbaned palace caretaker opens the main gate of Chandra Mahal, rich with its 18th-century brass work.

washed from bow to stern with holy Ganges water.

By the 1920s and 1930s, Indian royalty had taken to sporting in Europe, traveling from ball to ball and casino to casino. The Maharaja of Jaipur maintained polo ponies, racehorses, elephants, camels, Bentleys, Rolls-Royces, Cadillacs, Buicks, Fords, boats, planes and private railway cars. Jaipur state had its own currency and its own postage stamps.

But as the British left independent India in 1947, almost 600 princely states technically became independent, too. Nehru's government convinced most princes that their future lay in merging with the new nation. Thus they would keep their titles, get annual tax-free allowances (Jaipur's share amounted to more than $350,000 at the time), be allowed free medical treatment in their states, free water, free electricity, special passports, police escorts when out of their states and freedom from customs inspections. The state of Jaipur was dissolved and merged with 18 other states.

Then Prime Minister Indira Gandhi, in 1971, introduced a constitutional amendment bill, abolishing all princely privileges. In one blow the newest ruler of Jaipur, invested only in 1970 and recognized by the Indian government as Lt. Col. His Highness Raj Rajindra Sri Maharajadhiraj Sawai Bhawani Singhji Bahadur became, merely, Lt. Col. Sawai Bhawani Singh.

Anticipating loss of authority and more straitened circumstances, the royal family of Jaipur had already turned to politics and tourism. Bhawani Singh's stepmother, Gayatri Devi, was in Parliament; a royal residence, the 19th-century Rambagh Palace, had been turned into a hotel. Determined to survive, the Jaipur ruling family not only showed resilience, but a certain amount of old-fashioned craftiness. In 1975, when internal revenue officers raided royal premises, they found a hoard of undeclared wealth—among other things, about 1,917 pounds of gold, about 46 pounds of silver, jewelry, foreign currency and keys to foreign lockers. The motive for the raids, the royal family contends, was political. During Mrs. Gandhi's suspension of civil liberties, Bhawani Singh and Gayatri Devi spent several months in jail.

Jaipur has now grown well beyond the old city walls. Its population, by some estimates, is almost a million. New housing is generally ugly and ill-placed, with no thought given to famous views and vistas. The city's famed cleanliness is only a memory. Red-and-white shop awnings long ago gave way to solid, covered arcades—which, in turn, are now blocked by shop extensions. The pretty color of strawberry creams has,

of course, gone, and even the apricot shade is marred by garish billboards.

Still the city remains, in many ways, charmingly medieval: three-wheeled buses, overstuffed with passengers, careen past camel carts; wandering goats and cows munch what they can and wherever they can find it—radish tops from an unsupervised shopping bag, carrots from a pavement store. Monkeys reign on the frilly rooftops, and peafowl deafen city dwellers with their cries. A dreamy palace, Jal Mahal, stands just outside the city, partially submerged in a lake and surrounded by floating water hyacinths.

Many singers and dancers have left the city, but craftsmen have stayed. They find new patrons in the Cottage Industries Emporiums and in the mass market. In Sanganer, near the Jaipur airport, where block-printing was done even before Jaipur City was born, all empty land between houses and along the river is covered with drying cloth—wraparound skirts, new and strange for the cloth printers of the ancient Chheepa caste, but selling from New York to Japan.

Brass enamelers still work on their rooftops, bent over small charcoal designs with toothpick-thin lac crayons. Jaipur's blue pottery had almost died out when it was revived by a painter—Kirpal Singh Shekhawat. Only the bases of his pots are made on a wheel. He uses molds for the rest and joins the pieces together.

The city is adjusting to changing times. While older feudal lords complain because the government has made the private distillation of *aasha* illegal, most of their sons are joining the Indian army or going to work on distant tea estates. Some parts of the City Palace have been turned into a museum. The best furniture, draperies and objets d'art have been removed. Chandeliers are enshrouded in cloths; canvas curtains protect painted chambers from the sun and from pigeons; the fruit orchards have been leased; and the ground where the elephants battled is used by young cricketers.

Gayatri Devi, a former maharani, is out of politics for the moment and busies herself with the manufacture and sale of *durrees*—cotton carpets—and blue pottery. She has orders from Bloomingdale's.

Bhawani Singh, the former maharaja, lives in a small fortress-palace high on the crest of a craggy hillock. From his ramparts he can see the whole of the city that once, briefly, was his. He worries about his hotels and his travel agency and is thinking up schemes to encourage tourism in Rajasthan. Of course on Makar Sankranti, he, like everyone else in Jaipur, flies a kite.

Tourists explore huge masonry instruments of royal observatory. Pedestals and towers were observation posts for tracking the movements of the sun and stars.

Maharaja's chambers of Chandra Mahal—arches bright with colored glass, filigreed columns rising above cushioned floor—is still used on ceremonial occasions.

In 1960, area was covered by track and abandoned terminal. Lower Manhattan lies across harbor.

Today picnickers and dog walkers enjoy view of Manhattan's skyline from Liberty Park's grassy lawn.

From old rail yard to new city park

A decayed stretch of the New Jersey waterfront is being transformed into a public space with a dramatic view of the Manhattan skyline

One summer day in 1958 a Jersey City clothing retailer named Morris Pesin took his family to see the Statue of Liberty. Pesin spent two steaming hours fighting heavy traffic in the Holland Tunnel and on the clogged streets of Manhattan, and then he had to board a ferry for the final leg to tiny Bedloe's Island in New York's harbor on which the statue is located. When he finally arrived, he saw, just a few hundred feet across the water, a decayed and dismal-looking urban waterfront—and realized to his dismay that it was a part of Jersey City, the place from which he had started.

Two things struck Pesin. One was that the statue was closer to the New Jersey shore than to Manhattan —indeed, Jersey City was only 1,800 feet away. The other was that the waterfront—complete with the abandoned terminal of the Central Railroad of New Jersey, dilapidated railway cars, rusting tracks and rotting docks—made a disgraceful backdrop for a very special national monument.

Pesin decided to change all that. The shoreline eyesore, he believed, could be made into a superb urban park. To publicize his idea, he canoed from New

Jersey to the statue twice—and fell in once. When he became a city councilman he made the creation of a "Liberty Park" a priority, and badgered the state and federal governments for money to acquire land.

It took 18 years but in 1976, in time for the Bicentennial, Pesin's vision, or at least part of it, became a reality when 35 acres of Liberty Park were opened to the public. Now more than 700,000 visitors a year are coming to munch hot dogs from the snack bar, fly kites, stroll along the breezy walks and enjoy park-sponsored concerts.

But this is only the beginning. Ultimately Liberty Park will encompass 800 acres. It will be almost as big as New York's Central Park, and will also realize a bold plan in urban landscape architecture. It will include a crescent-shaped, harbor-front promenade backed by trees and meadows, and a two-mile-long serpentine waterway. The huge and historic terminal building will be refurbished to provide sites for concerts, meetings and a farmers' market. The Corps of Engineers is dismantling and hauling away old docks and sunken ships so that marshlands can be restored.

An area being developed as a wildlife refuge has already attracted 97 species of birds. With a fine eye for detail, state wildlife biologists are replacing rotting telephone poles with new posts, so that hunting birds like kestrels and short-eared owls won't lose the perches they need to survey the terrain. "It's quite a sight," says Joan Galli of the State Division of Fish, Game and Shellfisheries, "to see ibises, egrets and herons feeding along the mudflats with New York's skyline glinting in the background."

Progress has not come easily. Commercial developers once proposed to build a Disneylandlike theme park and a permanent World's Fair site within the park's boundaries. But New Jersey citizens formed a coalition and fought a four-month battle against the commercial plans. They won, then set up a citizens' committee to help direct the park's future and ensure that it remains an open space for public enjoyment.

From the new park, the torch-bearing statue seems startlingly close. The view of Miss Liberty, however, is from the rear. That does not bother Morris Pesin. He smiles wryly and says, "That's fine with us—because Jersey City is behind the statue 100 percent."

—MICHELLE I. GALLER

Photographs by Barrett Gallagher

Miss Liberty's Park

Terminal, from which passengers once took the ferry to Manhattan, will become site for cultural events.

A kite-flying visitor mimics the pose of Miss Liberty, seen holding torch aloft in background.

Behind Ellis Island (foreground), the remains of the old McAllister tug company will be removed and the area planted with fruit trees to attract birds. The completed 35-acre section is at upper left.

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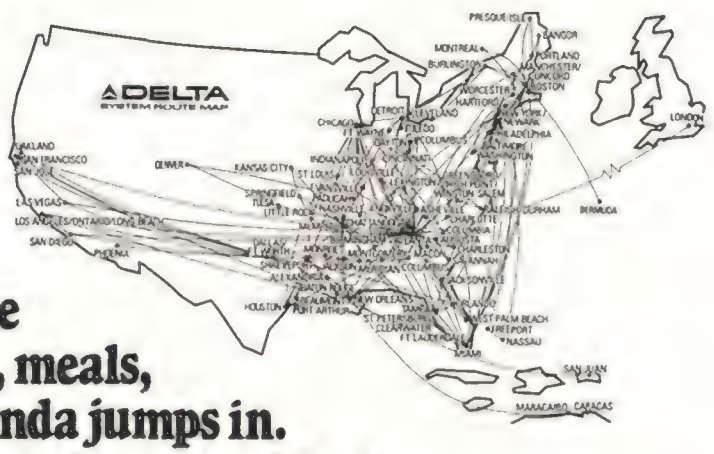

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By William Zinsser

They keep mixin' fact and fiction in Hannibal, Mo.

Mark Twain's boyhood home is real, 'Becky Thatcher's House' isn't, which doesn't bother tourists at all

From its terminal hard by a Mississippi River bridge, this open-air tour bus carries visitors to the high spots—some authentic, some fake—of Twain Land.

I had always wanted to visit Hannibal, Missouri, and, as I discovered on a drive across America, so have a lot of other people. When I reached the town late one summer afternoon all the motels were booked, and it was only by luck and tenacity that I finally found a room. All those people *couldn't* have been tracking down *Shoeless Joe from Hannibal, Mo.* (A song from the musical comedy, *Damn Yankees.*)

The crowdedness surprised me because Hannibal was obviously not a tourist trap of the ordinary sort, strenuously promoting its famous product, as, for instance, Mammoth Cave promotes its mammoth wonders. Along the highway I hadn't seen a single billboard luring me onward, like ONLY 20 MILES TO HANNIBAL, BOYHOOD HOME OF MARK TWAIN!

I thought I was a solitary pilgrim bound for a literary shrine. I wanted to wander around the town and stand at the edge of the Mississippi River and invoke the spirit of the writer who invented Tom Sawyer—or rather, reinvented the boy that he himself had been. Now I saw that I was surrounded by pilgrims, some shepherding flocks of children and grandparents.

The next morning we all left our various motels and drove into Hannibal. The motels were not in the town itself but out on that soulless strip of burger huts and gas stations where—on the perimeter of every town—the traveling American now does most of his sleeping and eating and refueling.

Hannibal (present population 20,000) was almost untouched by the plastic signs of progress. Its streets were quiet in the late-summer sun and, except for a grain elevator along the riverbank, it would seem to have changed little since the years—1839 to 1853—when Samuel Clemens lived there from the age of four until he left, nearly 18. In his books he rechristened it St. Petersburg, just as he rechristened himself Mark Twain, but by any name it was the same town and the same boy.

That was what made my day so strange: fact and fiction were thoroughly intertwined. Only two or three blocks of the community had been set apart as a historic district, and even there I could hardly tell where history left off and literature began.

Hannibal was not a Colonial Williamsburg, re-created from scratch, or a Sturbridge Village, reincarnated from the past with local citizens dressed up in buckle shoes plying extinct trades. I was grateful for that—I've seen enough blacksmithing and candle dipping to last me well into my sunset years.

I went first to Hill Street, where I found a two-story white house that looked—and turned out to be—authentic. It was described on a plaque as "The Boyhood Home of Mark Twain, Erected in 1844 by his father, John Marshall Clemens." Fair enough. Attached to the house was a white board fence, and in front of it was a historic marker (p. 163) that said: TOM SAWYER'S FENCE HERE STOOD THE BOARD FENCE WHICH TOM SAWYER PERSUADED HIS GANG TO PAY HIM FOR THE PRIVILEGE OF WHITEWASHING. TOM SAT BY AND SAW THAT IT WAS WELL DONE.

I stood by, where Tom allegedly sat, and felt the first twinges of confusion. It wasn't just the grammar of the descriptive paragraph that gave me trouble; even a grammarian might have trouble disentangling that. What bothered me was that it *wasn't* Tom Sawyer's fence. It was a fence. But there wasn't any Tom Sawyer, or any reason to believe this was *the* fence.

To clear my head I turned around and looked at the buildings across the street. One was a large white house that had a plaque identifying it as "Becky Thatcher's House":

By way of homework for this article, the author, master of Branford College at Yale, reread his copy of Tom Sawyer.

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The sign was hardly a cure for my confusion. If there was no Tom, was there a Becky? I went into a bookstore and told the proprietor there that I was having a hard time distinguishing the truth from fancy.

"I don't blame you," she said. "That's really the Hawkins house, and the little girl who lived there was Annie Laurie

Samuel Clemens' real boyhood home was built by his father in 1844.

Hawkins—though everybody called her Laura, including Sam. I mean Mark Twain. Most of the folks who visit Hannibal never heard of Samuel Clemens. They only know Mark Twain and Tom Sawyer and Huckleberry Finn and Becky Thatcher. So it wouldn't do any good to call it the Hawkins House, even though Laura Hawkins was the inspiration for Becky Thatcher."

Laura, according to a souvenir book that I hurriedly consulted, was two years younger than Sam Clemens. When she was an old woman she told an interviewer: "I can see him in my mind now as we started to our first school together more than 60 years ago, he barefooted

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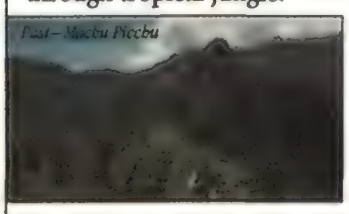

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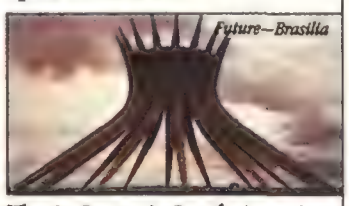

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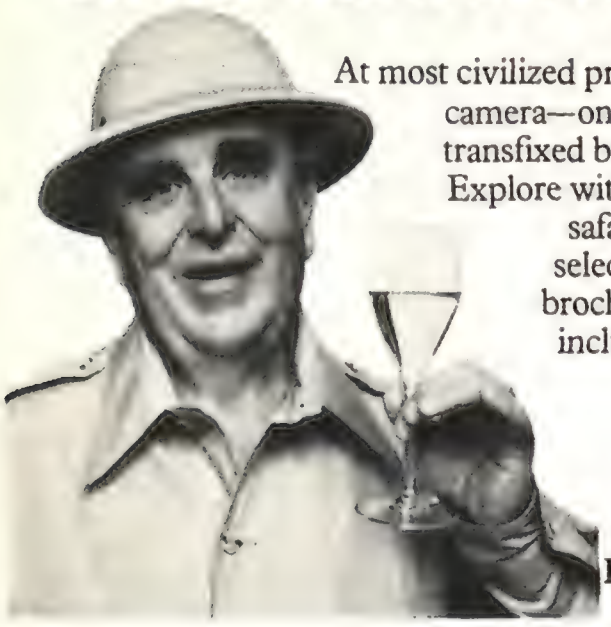

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and the fingers stained with mulberries as he divided the berries with me, a little girl in calico dress, sunbonnet and pigtails." Pretty good recall.

Emerging into the sunlight, I looked at the building next to "Becky Thatcher's House." It was identified as "Mark Twain's Father's Law Office," and across the top it had a sign that said J. M. CLEMENS, JUSTICE OF THE PEACE. Reality again.

I strolled down to the Mississippi River, only a few blocks away. It was

Got up in Tom and Becky costumes, Hannibal teen-agers pose for tourists.

wide—"a trifle over a mile wide," as described in *Tom Sawyer*—and I tried to imagine what it was like to grow up in the presence of such a river before the age of cars and bridges. The Mississippi would have been a highway to the rest of the world—to big cities and far places. No boy could watch the steady traffic of steamboats and not yearn to know where everybody was going and what was around the next bend.

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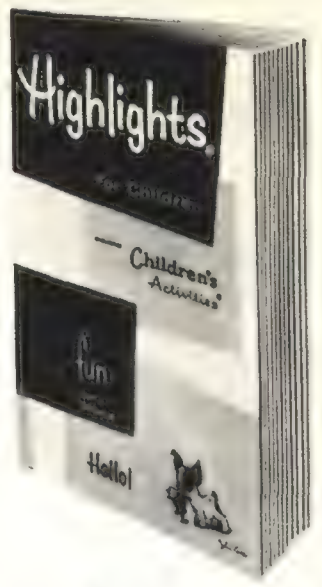

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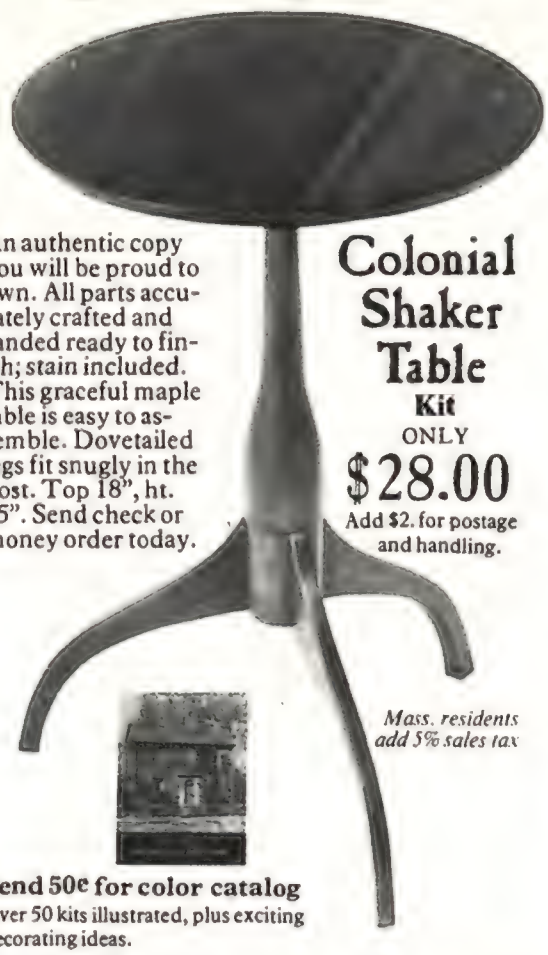

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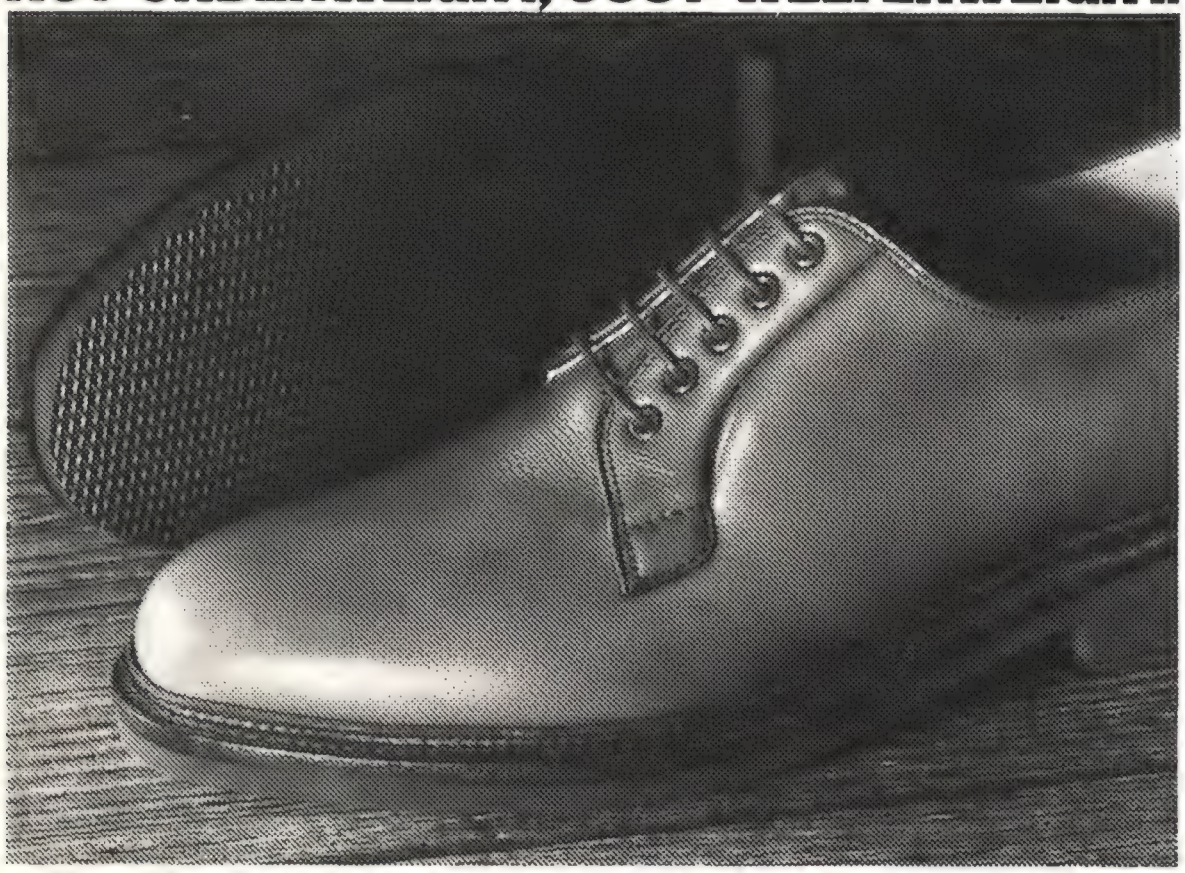

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stern-wheel excursion boat that made periodic sightseeing trips on the river. This was "tourism," but it was what I wanted—a chance to be out on the Mississippi, to feel the tug of its current and to look back at the town. My fellow tourists and I climbed aboard. The boat cruised up and down the river for a while and our guide pointed out various landmarks along the shore. One was a cove where steamboats used to stop in Mark Twain's day so that passengers could get off and picnic and explore a nearby cave.

This was the cave, our guide said, where Tom and Becky got lost and where

Mark Twain Cave, a fictional terror, is now a U.S. Natural Landmark.

Injun Joe died. Today it is named the "Mark Twain Cave" and is designated a U.S. Natural Landmark. I thought it would be more aptly called a U.S. Fiction Landmark. True, it was a natural phenomenon that was very real to the steamboat passengers who visited it a century ago. But Mark Twain gave it a reality that is even stronger. The days and nights that Tom and Becky spent in that cave, without light and almost without hope, remain vivid in the memory of every reader of the book. The natural landmark was appropriated and improved by a natural storyteller.

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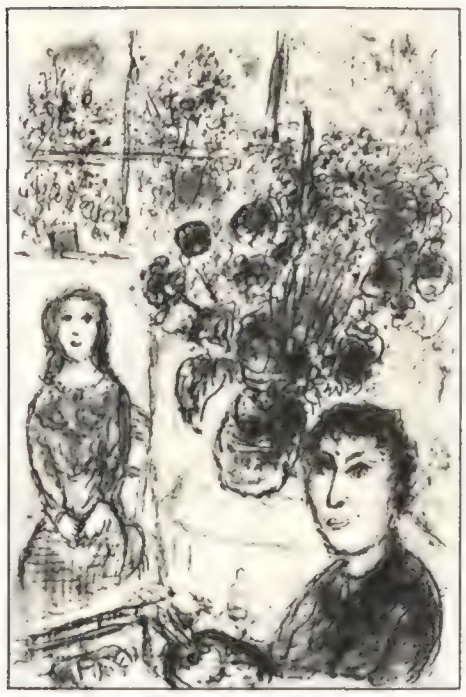

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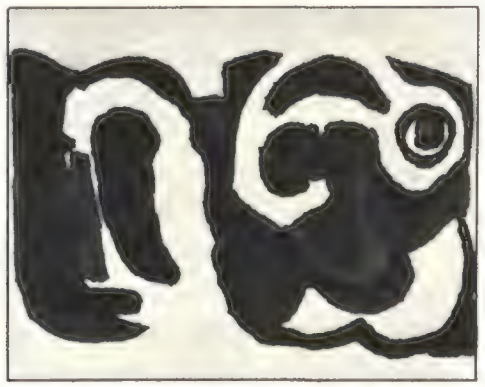

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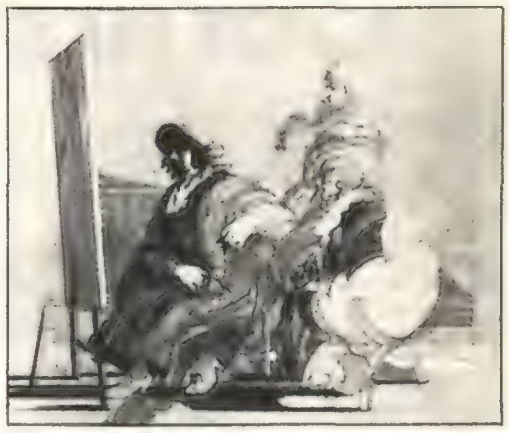

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and circled Jackson's Island—the island, as our guide explained, where Tom and Huck Finn and Joe Harper played pirate and listened to guns being fired over the water by the townspeople, who thought that the boys had been drowned, to raise their bodies. This was one name that Mark Twain didn't bother to change. He called it Jackson's Island in *Tom Sawyer* and described it as "a dense and almost wholly unpeopled forest."

It still looked dense and unpeopled to me, and I could understand why Tom and Huck and Joe, after several days of relishing total freedom, of waging pirate raids and Indian wars, "dropped into the 'dumps,' and fell to gazing longingly across the wide river to where the village lay drowsing in the sun." Freedom is all very well—for a while—but homesickness is not. Jackson's Island was a lonely place, and I was glad when our boat completed its circuit around the far side and started back across the Mississippi, heading for the village that lay drowsing in the sun.

I walked up from the dock and through the streets of Hannibal, past the Mark Twain Dinette and the Twain Pet Center and the Becky Thatcher Restaurant, and went back to the bookstore. It was jammed with tourists. I was struck by the amazing number of books written about as well as by Mark Twain. His own output was immense. But so was the output of all the scholars and biographers and critics who wrote about him. It had never occurred to me to wonder who was the most popular author in American literature. I still don't have any statistics,

Not *the* fence but at least it's the right *kind* of fence . . . that's Hannibal.

but after that day I would bet on Samuel Clemens.

Why else had so many of us journeyed to Hannibal from so many parts of the country? We were drawn by a remarkable literary feat: the creation of a set of characters who are still alive in the streets of a Missouri town, more real than the author himself. It finally didn't matter to me that fact and fiction were so mixed up. I was quite ready to believe that a boy named Tom Sawyer had played in those streets and that "Becky Thatcher's House" was really Becky Thatcher's house. Mark Twain had cast a spell over us all; that's why we were there, rubbernecking in Hannibal.

We were also there, I think, for a deeper reason. We were pilgrims to an American childhood that no longer exists. Tom Sawyer is the child we wish we had been and that some part of us would still like to be—impatient with authority, climbing out of the bedroom window at night, playing pirate, exploring caves, building rafts and drifting down rivers to see what's around the next bend.

Today the mystery is gone. We know what's around the next bend—and every bend. We have cars to speed us there and bridges to take us across the rivers. Or we can stay home and let television bring the big cities and far places to us. The TV screen is now our bedroom window, pulsating with "adventure." Why climb out, except to look for adventures that are real? Are any such adventures left, such carefree and prankish boyhoods? I saw their shadow briefly in Hannibal.

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Theodore Roosevelt (caricatured by Gruelle in Cleveland *Press*) loved birds

. . . as did his companion, Lord Grey, Britain's longtime Foreign Secretary.

By Joseph Kastner

An English bird walk for President TR? Carry on!

Two top leaders gave gaping newsmen the slip. However, no summit talk echoed from the copses—just birdsong

No American President had ever made such a request—one which called for response at the highest levels of diplomacy and, of all things, ornithology. But this President was Theodore Roosevelt, and the world was accustomed to seeing him tumble precedents if so he chose.

Before he left office in 1909, Roosevelt invited the British ambassador to the White House. When his term was up, said TR, he would like to go on a bird walk in England. It wasn't so much that he wanted to watch the birds. He wanted to listen to them. Could the ambassador arrange for a qualified guide? It would have to be someone who could accompany him and "as the songs were heard, tell him what the birds were."

The ambassador, Lord Bryce, had a rare understanding of Americans—he was author of that classic work, *The American Commonwealth*—but this request for a bird walk must have surprised him. He relayed it to the Foreign Office, where it went to the one Englishman best suited to serve as the President's guide: the Foreign Secretary himself.

Edward Grey, Viscount Fallodon, is now best remembered for a rueful remark he made on the eve of Britain's entry into the first World War. Looking out of his office in Whitehall at dusk on August 3, 1914, he watched London's streetlamps being lit. "The lamps are going out all over Europe," he said; "we shall not see them lit again in our lifetime."

In his time, Grey was known as the man who served the longest continuous term as Foreign Secretary (1905-1916) and also as a superb naturalist. An expert ornithologist and fly fisherman, he had what one authority called "a genius for bird observation and for wild duck culture" while others compared his book *Fly Fishing* to Izaak Walton's *The Compleat Angler*. British cartoonists caricatured him as a long-legged bird.

Grey was bemused by Bryce's message. It was, he wrote, "very attractive that the executive head of the most powerful country in the world should have this simple, healthy desire to hear the songs of birds." And though it was not "a necessary qualification for the Secretary of Foreign Affairs to know the songs of birds," he was delighted to be able "to arrange this little matter satisfactorily between us as if it was part of our official duties, without feeling for once obliged to call in experts."

Having assigned himself as Roosevelt's guide, Grey began to voice doubts. "Perhaps," he said of the proposed walk, "he will not care so very much about birds

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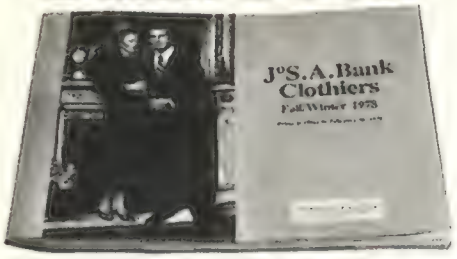

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Grey often appeared heronlike, but in a 1913 *Vanity Fair* he's a secretary bird with olive twig for troubled Balkans.

and possibly after an hour or so, he will have had enough."

He mistook his man. When it came to natural history, Roosevelt could never have enough of anything. No American President ever had so deeply grounded a knowledge of nature. Even Thomas Jefferson, for all his reputation, was not the field naturalist that Roosevelt was.

Until about the time that politics called him, TR had planned to make his career in natural history. As a boy of eight, he set up "The Roosevelt Museum of Natural History" in his home. As recorded soberly in a boyhood memoir by his cousin Emlen Roosevelt, "At the commencement of the year 1867, Mr. T. Roosevelt, Jr. started the Museum with about 12 specimins."

The collection later included bird skins and eggs, minerals, insects, even the skull of a seal; many of the specimens had been picked up on young Teddy's explorations in upper Manhattan and along the Hudson. After a trip to Egypt and the Holy Land, he came home with more than 100 skins of Nile and Palestinian birds, some of which, along with others, he gave to the Smithsonian Institution (it still has them).

At Harvard, as Roosevelt started a new collection and began to concentrate on the study of birds, his notes give more details about their songs than about their color or habits. As belligerent about birds as he was about most other matters, he charged into a local controversy

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These were big grapefruit, unusually big, And they had a faint red blush on their skin. When Dr. Webb sliced open the grapefruit, the fruit was a **brilliant ruby red** in color.

Doctor Webb decided to taste this strange new grapefruit. The fruit was perfect, juicy and luscious. It wasn't sour like other grapefruit either — it was naturally sweet without sugar.

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This is a picture of the actual harvest of this season's first Ruby Reds.

fruit is small enough to pass through this ring — we don't pick it! It simply isn't big enough to qualify as a Royal Ruby Red!

Even after picking there are other careful inspections each fruit must pass before I'll accept it. I size the fruit. And I grade it for beauty. Sometimes the fruit will be wind scarred. I won't accept it. Or sometimes it will have a bulge on the stem end that we call "sheep nose." I won't accept it. You can see I really mean it when I say I accept only **perfect** Royal Ruby Reds.

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by disputing a venerable amateur naturalist, Dr. Thomas M. Brewer, who had defended the English sparrow against charges that it was a nuisance and a plague. Roosevelt declared that the bird was a bully that drove native birds from their rightful territory. Some Boston ornithologists were amused by the young man's brashness. Others, after examining the evidence, agreed with him.

Warblers on the White House lawn

Toward the end of his stay at Harvard, Roosevelt gave up natural history as his lifework and took on the cause of "better government." But his old passion lingered. As President, he would sit under an apple tree on the White House lawn and, with his binoculars, count migrating warblers—complaining, as bird watchers always do, about the difficulty of telling one fall warbler from another. He was particularly proud to find a pair of saw-whet owls that had settled in the south portico. In a list of 57 birds he saw on the grounds, he reported a pair of sparrow hawks spending "two winters on and around the White House grounds, feeding on the sparrows—largely, thank Heaven, on English sparrows."

At Pine Knot, a cabin in Virginia which served as his Camp David, Roosevelt earned a historic place for himself in American ornithology. In May 1907, a flock of wild pigeons flew by and, following them closely, the President decided they were passenger pigeons. This was astonishing, for though the pigeons once flew over America by the multimillions, they had been slaughtered by hunters and for years considered virtually extinct in the wild. Cautiously, the President consulted his famous naturalist friend John Burroughs. Burroughs, like other naturalists, was skeptical at first. Today, however, ornithologists generally believe that TR was correct—the birds really were passenger pigeons—and that the President of the United States was one of the last people known to have seen them in the wild.

Burroughs, who once roamed Yellowstone Park with Roosevelt, admired the professional way the President prepared the skin of an uncommon mouse he had caught. John Muir, sage of the Sierras, went with TR to Yosemite (after they escaped from the Secret Service), impressed the President with arguments for

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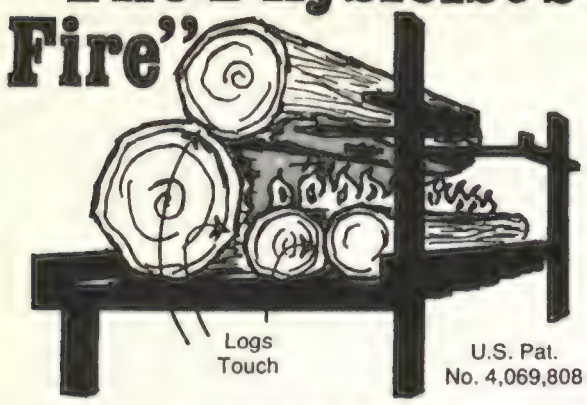

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From *Scientific American*

(August, 1978, pp. 142–146)

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A pair of skylarks share nest-keeping chores in an English meadow. TR was as charmed as were Wordsworth and Shelley with their song-filled spiral flight.

conservation, but disappointed him with ignorance of birds.

In May of 1910, having relinquished the Presidency and gone big-game hunting in Africa, Theodore Roosevelt arrived in England. Grey observed that he had planned things "so minutely as to time his visit at. . . . the singing of the birds." Yet Grey, having noted Roosevelt's "royal progress" elsewhere, thought "this little walk . . . would be forgotten and crowded out by greater matters." It wasn't. Roosevelt sent word to the Foreign Secretary about their expedition. "At the appointed time" on June 9, Grey wrote, "we met at Waterloo station" and proceeded to Hampshire.

Reporters were ordered not to come along—"birds are self-conscious," remarked the Secretary, "and do not like to be interviewed." This only confirmed the press' belief that birds were merely a cover for a top-secret meeting. Off the two went to what Roosevelt called "the pretty smiling valley of the Itchen," familiar to him through reading *The Natural History and Antiquities of Selborne,* by the famous 18th-century naturalist Gilbert White, who used to wander there.

It was "good singing weather," Grey reported, "not hot and dry, and the birds sang well." His companion had not only "a remarkable and abiding interest in birds, but a wonderful knowledge of them. When a song was heard, I told him the name, it was unnecessary to tell him more. He knew . . . the kind of bird it was, its habits and appearance."

Roosevelt had, moreover, "one of the most precisely trained ears for bird songs that I have ever known, so that if three or four birds were singing together, he would pick out their songs, distinguish each and ask to be told each separate name." And when, farther on, they heard a bird for the second time "he would remember the song from the first telling and be able to name the bird himself."

The skylarks (above) attracted Roosevelt. "They spring from the grass," he wrote, "circle upwards steadily singing and soaring for several minutes and then return to the point whence they had started." As he watched, Grey pointed out that "they exactly fulfilled Wordsworth's description. They soared but did not roam." To the American, the song of the blackcap warbler was lovelier than the nightingale's and, on hearing the blackbird sing, he was indignant that the beauty of its song was not widely recognized. He fulminated over this, wondering how the injustice had come about. "I suppose one of his troubles has been his name," he concluded, "just as with our own catbird."

As they were walking under a fir tree, the two heard a small series of notes. Grey identified the singer as the "golden-crested wren." Roosevelt replied "that is exactly the same song of a bird that we have in America"—the golden-crowned kinglet. That kinglet is, in fact, considered a close relative of the British bird, which is also a kinglet, now called the goldcrest (172-173). Checking up later on Roosevelt, Grey was impressed to be told

Mr. Kastner's article on John Bartram, based on his book A Species of Eternity, *was in the October 1977* SMITHSONIAN.

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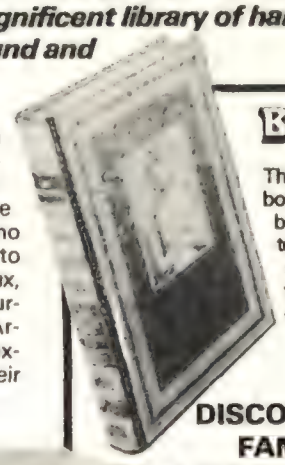

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that this was the only birdsong that England and America have in common.

At dinner that evening, the two went over their list: they had seen 41 birds and heard 23, a highly satisfactory count. Then Grey took Roosevelt down to Southampton, where he sailed for home saying, "I passed no pleasanter 24 hours during my entire European trip."

There was one significant result of their walk. Back home Roosevelt gave his support to international measures to protect migratory birds, and the first treaty

British goldcrest, above, called "golden crested wren" by the two famed bird watchers, has a song similar—

to do this was signed by Great Britain (on behalf of Canada) and the United States in 1916.

There was a more personal reward for Roosevelt. He had, he said, in his *Autobiography,* known England's birds through the words of its poets. Now he could say that he knew them and their songs at firsthand—"the lark of Shakespeare and Shelley . . . the nightingale of Milton and Keats . . . Wordsworth's cuckoo [and] mavis and merle singing in the merry green wood."

but not quite identical—to the golden crowned kinglet, an American cousin, below. TR noted the similarity.

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From the results of these tests, our field men then schedule deliveries from our growers. Because of varying types of soil within a given vineyard certain areas may mature earlier. If the vineyard is a large one, these areas are picked first.

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Book reviews

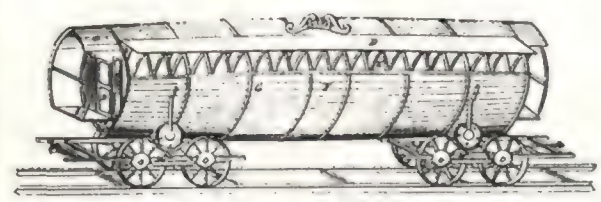
The American Railroad Passenger Car
John H. White jr.
(Johns Hopkins University Press, $45)

In 1840 the South Carolina Railroad proudly introduced its new barrel-shaped day coach constructed from wood staves held together by iron bands. It was modeled after local hogsheads used to ship tobacco. The company enthusiastically claimed the car's round body would shed live cinders and, if derailed, would roll down embankments without damage.

A few years later the company regretfully reported that its innovative design was "frequently condemned by strangers at first sight." Like so many other earnest attempts at railroad coach building, the barrel car disappeared from the scene until retrospectively resurrected by John H. White jr., curator of transportation at the Smithsonian Institution, in his compendious book *The American Railroad Passenger Car.*

The mammoth compilation of fact and lore is 699 pages long, 11 by 13 inches in dimension and weighs an even 9 pounds. Here the common coach is at last given its proper place in the lineage of the sleeper, the parlor car, the diner, the buffet car, the observation car and the opulent private car.

White details them all: their designers and builders, their construction and economics, the moneyed traveler and the poor westbound emigrant. He chips



Hacker's hogshead in service in 1840.

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away at some old myths and comes forth with fresh anecdotes. Nearly 800 photographs, line drawings and diagrams illustrate the text.

While the lowly coach deserves to be rescued, romance remains on the side of first-class travel. The industry's competitive efforts to attract, pamper and please its affluent customers, all within the confines of a rolling boxlike structure, make compelling reading.

The sleeper was the first of the luxury cars, but it did not please all early passengers. A traveler in the 1860s who paid 25 cents for an upper berth wrote that "it was like trying to sleep on the back of a runaway horse." Another complained, "You can never sleep a wink for the jarring and noise of the train, and never will be able to dress and undress and bathe like Christians."

The boudoir car of the late 1880s solved the privacy problem with separate compartments, but the timing was wrong. The very name was unacceptable to the Victorian mind; as White notes, "There was a suspicion that unspeakable acts took place behind the locked doors of the boudoir compartment."

The last of the first-class cars to arrive was the diner, a costly liability for the railroads but a joy to travelers. Until World War I the usual cost of a dinner was one dollar. The elegance of linens, silverware and fresh-cut table flowers (the New York Central's florist bill ran to $2,000 monthly), plus a sizable staff, made profits virtually impossible.

But it was good while it lasted. On the New Haven's Yankee Clipper of 1930, White reports, "The waiters were in smart white uniforms and shoes; the steward wore formal attire. Only the choicest cuts were served, and all vegetables and fruits were fresh—no canned foods were used. Patrons might even choose between eggs with white or brown shells."

In his fondness for the ordinary car, White includes a chapter on the baggage express and mail cars that have suffered even greater historical neglect than the coach. However, he concedes that nothing on the rails will ever surpass the private car for public fascination. The private car started as a perquisite for railroad officials who sometimes went to great lengths to hide ownership from critical stockholders. It became a status possession for the very rich, peaking in

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1930 when about 900 were in service. That same year *Fortune* magazine estimated annual operating costs for a private car at $33,733.50. The cost didn't bother railroad magnate Louis Hill, who made do with two. The second was fitted out as a garage to transport one of his automobiles.

It is more than mere curiosity about the rich that makes the private car an object of fascination. It is the way we would all like to travel—with servants, sunken parlors, solid silver bathtubs and a sunroom on the observation platform.
—*Thomas W. Kelly*
Project Director, American Association of State Colleges and Universities

The Violet Dots
Michael Kernan
(George Braziller, $7.95)

The Big Push on the Somme came the first of July 1916, and the British command gloated over its chances for breaking the long trench stalemate and routing the enemy. The battle plan was no secret. It had even been announced in the newspapers, and nearly everyone thought it would succeed. One brigadier confidently told his men: "When you go over the top, you can slope arms, light up your pipes and cigarettes and march all the way to Pozières before meeting any live Germans."

The British artillery bombardment preceding the attack was thought to have been so punishing that command assumed (contrary to intelligence reports) all the Germans had either been slaughtered in their mudholes or driven insane. On the morning of the first, after a great mine explosion, the British soldiers moved out in ceremonial step. They had been told to refrain from cheering.

Machine guns opened fire from the German trenches. In ten minutes, an estimated 14,000 British soldiers were dead. It went on and on.

A reporter for the *Washington Post,* Michael Kernan became "fascinated and horrified by the story of the Somme," and went to England hoping to find one or two survivors to interview for an article. In the drab Northumberland coal town of Choppington he met a retired miner named Tom Easton: "Stocky, not more than 5 feet 4 inches, with ruddy, firm skin, he looked far younger than his seventy-nine years." A man of extraordinary

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resilience and curiosity, Tom had long been compiling an exact record of his life, jotting down lines of vivid, direct prose whenever he had some free time. He shared with Kernan this "shoebox full of small memo books and pocket diaries, dog-eared and scuffed, one for each year"; and the two men began having long, intense conversations about the war, Tom's career in the mines, his family, his beliefs.

In *The Violet Dots* (the title comes from a map of the Somme area "riddled with" numbered violet dots marking British military cemeteries), Kernan has gathered the diaries and interviews into a subtle, ingenious work of biography. Interspersed throughout the book are newspaper clippings, wartime letters, dispatches from generals, marching songs, treatises on mining, glimpses of English village ways and other fragments chosen to complement the main story. The book gives the impression of a cyclorama, stark yet colorful, that portrays the life and times of one man who survived that first day on the Somme.

Tom Easton's diaries give *The Violet Dots* its real power, for without them we would have but fleeting visions of his courage, compassion, perseverance, sense of duty. All his life Tom has been (in Kernan's words) a man of "rocklike reliability," as the diaries show.

Easton describes laboring 52 years in the Choppington pits without ever once coming to work late; serving on endless committees that tried to improve the brutal, hazardous working conditions; raising a large family; helping his neighbors whenever they needed him; and even volunteering for arduous night rounds during World War II, when he still had his shift at the mine all day.

"We were born in a time when if you missed something, you missed it," Easton had explained to Kernan during one of their conversations. "Reliability counted for something."

Elsewhere his wife remarks: "They can't keep him down."

Kernan persistently steers Easton back to that nightmarish walk across No-Man's-Land on the first of July, coaxing him into describing what he felt and thought. The task proves difficult, and at one point, growing angry, Tom says, "Write me your questions after. I'm tired of talking about the war."

Eventually Kernan arranges for them

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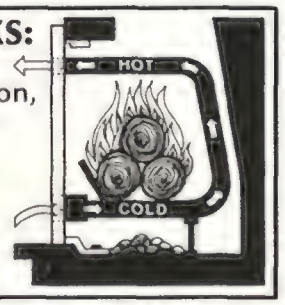

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to take a three-day trip to the Somme. As they walk the battlefield, Tom pointing out landmarks and saluting fallen comrades, Kernan has a revelation: he sees the attack clearly for the first time, visualizes Tom charging toward the front. This last section of the book is filled with eerie, compelling images. It is much to the author's credit that he avoids melodrama, doesn't strain for grand metaphors about Death and War.

Kernan simply keeps his eye on the subject, as he has done all along, and summarizes nicely: "After the war, nobody ever stepped on Tom Easton; he had been stepped on by experts."

—Ronald Varney
Free-lance writer and critic

That Jazz!
Ethan Mordden
(Putnam, $10.95)

Everyone knows what the Twenties did: they roared. Out of the carnage and disillusion of a European conflict came a decade boiling over with all manner of newness, madness and high spirits. "One might as well expect a high sense of tragedy in an undertaker," wrote historian Louis Mumford, "as heroism in the generation that follows a war."

From the vantage point of now, the Twenties look awfully familiar, the first of the "Me" decades, an early hotbed of faddism and media sensationalism. What really set it apart from the past, theorizes Ethan Mordden, was simply "the experience of change itself, the omnium-gatherum of revolution that decayed or enriched—depending on how much you liked your life before—virtually all of what the population had taken for granted as the American mode. Jeepers, at each step you took, every time you turned left or right, there was the future going into its dance. . . ."

Ethan Mordden, obviously, does not belong to the Just-Tell-the-Facts-Ma'am school of historians. His is a breezy, even flip way of writing, a style not unlike the decade he deals with, weaving in and out of events peekaboo style. His words almost never do the expected, and he has a gift for metaphor that is at times astonishingly apt, as when he talks of beleaguered labor unions "that doggedly continued to assemble themselves like bad toys coming to life in the shop at midnight. . . ." or describes the noble

but futile experiment of Prohibition as "taped on [the Constitution] like a spinster's anonymous hate letter to somebody's front door. . . ."

The Twenties were not born all at once, Mordden says, but rather gradually—an era that invented itself, turning out an astonishing variety of characters in the process. There was hot-blooded show-biz evangelist Aimee Semple McPherson. There was cynical iconoclast H. L. Mencken, who talked of the average American turning "despairingly to honest imbecility"; Adman Bruce Barton talked of Jesus as "The Man Nobody Knows," presenting the Savior as a magnetic organization man with one heck of a board of directors; lovebirds Daddy

An Art Deco aspect of the Twenties.

and Peaches Browning talked in baby talk until she charged him with mental cruelty and heaving telephone books through a transom; and avant-garde composer Charles Ives talked not much at all, preferring to simply listen. "You goddarn sissy-eared mollycoddle," he said once to a concertgoer unhappy with a modernistic piece, "when you hear strong masculine music like this, stand up and use your ears like a man!"

Presiding over much of this madness was Calvin Coolidge, "everything the era . . . was not—flat, unnuanced, inactive and untroubled." If Mordden wastes few kind words on him, he has surprising things to say about the generally laughed-off Warren Harding, emphasizing some of his progressive acts—speaking out harshly against racial inequality before a segregated audience in Alabama, pumping for the abolition of child labor, inviting socialist Eugene Debs to the White House after granting him a par-

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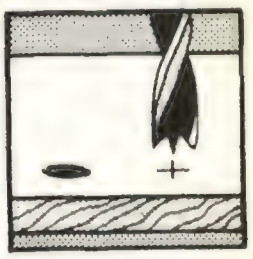

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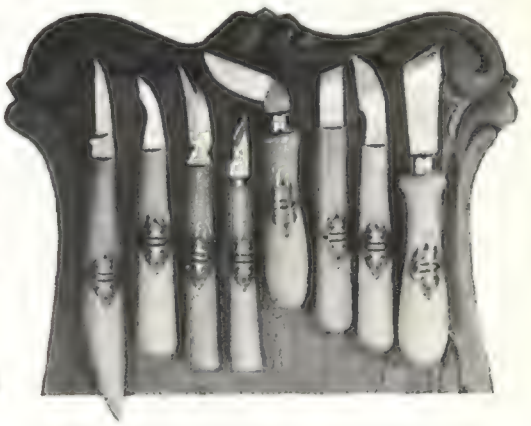

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don—and pointing out that, after all the controversy, his death may have been caused by poison and not natural causes.

Mordden is at his best when he stops his verbal dancing long enough to get into an event for four or five pages, taking the time to explain it cogently and in detail. His explication of the intricacies of the Teapot Dome scandal, the Watergate of the Twenties, is excellent and clear, and the same goes for his treatment of the Sacco-Vanzetti affair, where he concludes that maybe the pair was guilty after all. And when he talks of Clarence Darrow's dissection of an aging William Jennings Bryan in the Scopes trial, with the lawyer cutting in on him "like the Lord smiting Nebuchadnezzar," he makes it a sad and moving moment indeed.

Unfortunately, Mordden is not always at his best. Intriguing though his style is, it and his passion for obscure words—he uses "louche" on no less than three occasions—have a tendency to get in the way of the facts he is nominally trying to communicate, not to mention the ideas stringing them together. Though his enthusiasm makes the Twenties seem almost new and exciting, the way he transmits his fire makes this at times a hard book to get a grip on.

—Kenneth Turan
Cultural critic, writing in Los Angeles

Adirondack Fishing in the 1930s: A Lost Paradise
Vincent Engels
(Syracuse University Press, $8.95)

On first seeing the Adirondacks, the author was struck with such a strong sense of *déjà vu* that, he writes: "Had I believed in a previous existence, I would have thought that I was returning to a land where I had once lived and been torn from much against my will." From the outset it is clear that this book is not just about fishing. Rather, it is about fishing in a very special part of the world at a time when a very special way of life was disappearing.

Gone already were the days when the Adirondacks were the exclusive playground of the very rich, with their private railway cars and elaborate "camps." Gone, too, were most of the old-time guides who escorted city gentlemen on fishing and hunting trips. One who remained in the 1930s was Bige Smith of

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Deerland, then still guiding for his friend Mr. Henry Abbott, an urbane New York inventor. Both were in their eighties. During what Mr. Abbott called "the best times," from the 1890s until about 1914, he reached his modest South Pond camp via a complex network of railway, steamer and stagecoach.

It was, of course, by automobile that author Engels came, those summers, to his father-in-law's place on Long Lake. And if the main attraction was the setting, the scene, fishing was certainly not without importance. For there were still trout, and not just any trout, but the true native brook trout, the squaretails, "heavy bodied, with jeweled sides, dark green-blue vermiculated backs, and underbellies that as August nights began to cool were transformed from dusky pearl to flaming purplish red." In the high waters at the foot of Mt. Marcy they were abundant, but at lower elevations Engels and his friends would find them lurking only near the cold spring holes of the lakes and streams. No purists, if the trout weren't biting—and squaretails were quite capricious—they went after bass or pike, or even that favorite eating fish of the guides—bullheads. (Engels once caught a sizable bullhead on a No. 12 Dark Montreal.)

If nothing was biting, one could always climb a mountain. From atop Mt. Colden (altitude 4,712 feet) Engels had most of the Adirondacks laid out before him: the ancient dark hills covered in spruce, hemlock, balsam and pine; the myriad lakes and ponds that dot the landscape like rain puddles; and just below, full of squaretails, the Opalescent River, Lake Colden, and a lake magically called the Flowed Land.

Other days, Engels might go over to hear Mr. Abbott reminisce about the old days. There is a photograph showing Bige, large and portly in his overalls, and Mr. Abbott, trim and precise in Norfolk jacket, knickers, white shirt and bow tie, setting forth to search for Lost Pond. (They found it, but it promptly became ignored again.) Another photograph shows a guide boat built by Bige's brother George Smith. These uniquely Adirondackian boats, crafted of white cedar and spruce, light enough to be carried by a guide from pond to pond, were—and are—astonishingly beautiful, both to behold and to row. "The thin-bladed oar . . . dipped into [the water]

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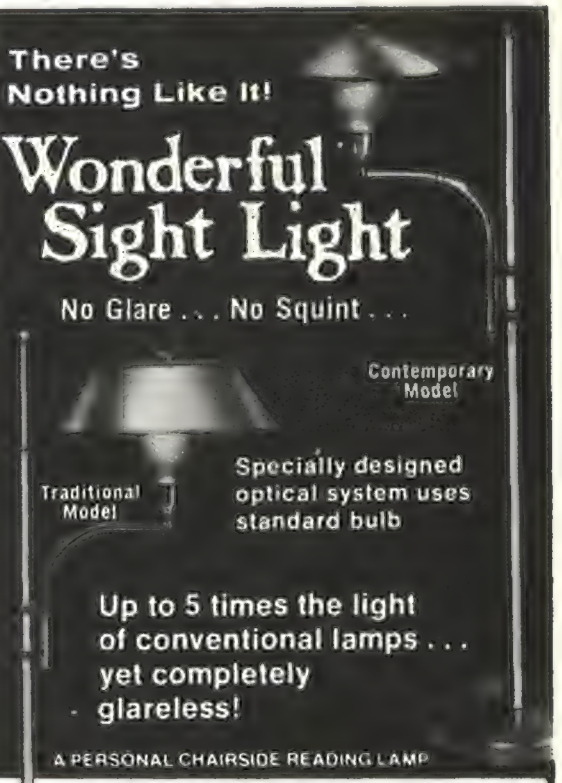

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There are fishing stories and nonfishing ones (like Engels' visit with Noah Rondeau, "the hermit of the Adirondacks," who practiced daily with his homemade bow and arrow, his target the outline of a game warden's hat). Engels' relaxed and intimate writing style is just right for his subject matter, and the old photographs nicely complement the text, but one wishes there were a map—just exactly where *is* Boiling Pond, "where the trout grow long and lean on a diet of leeches"?

Today the squaretail is virtually gone from these lovely lakes and streams, as another avid fisherman, Charles L. Todd, reveals in his disturbing Afterword. Acidification of the waters caused by exhaust fumes from the industrial Midwest and Northeast is doing great harm to formerly flourishing fish populations. But if the ending is sad, the book itself is sheer pleasure, and one is thankful that Mr. Engels was around in the 1930s to record this paradise before it was lost.

—*George Kittle*
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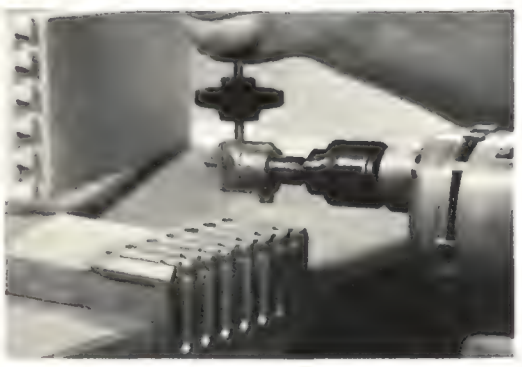

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Additional reading

Rockefeller art collection (p. 42)

The Asmat of New Guinea: The Journal of Michael Clark Rockefeller, Museum of Primitive Art, distributed by the New York Graphic Society, 1967

Oceanic Art: Myth, Man and Image in the South Seas by Carl August Schmitz (translated by Noman Guterman), Harry N. Abrams, 1971

African Art: An Introduction by Frank Willet, Praeger, 1971

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Indian Art of Mexico and Central America by Miguel Covarrubias, Alfred A. Knopf, 1957

Eskimo Art: Tradition and Innovation in North Alaska by Dorothy J. Ray, University of Washington Press, 1976

Firewood (p. 54)

The Woodburners Handbook by David Havens, Harpswell Press (Brunswick, Maine), 1973

The Complete Book of Heating with Wood by Larry Gay, Garden Way Press (Charlotte, Vermont), 1974

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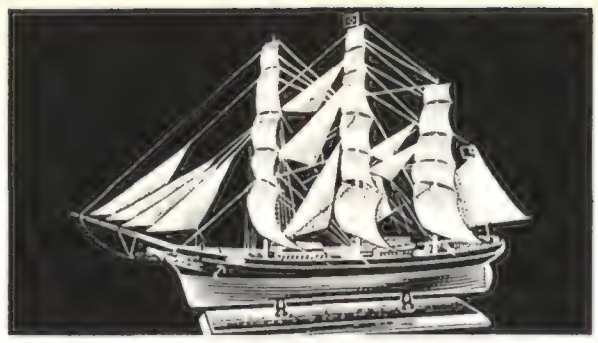
The Woodburners Encyclopedia by Jay Sheldon and Andrew Shapiro,



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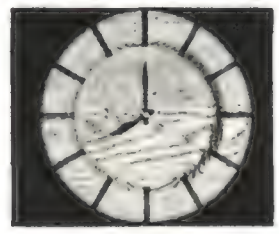

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Beverly, Ma. 01915

Vermont Crossroads Press (Waitsfield), 1976

Spiders (p. 66)

Spiders and Their Kin by H. W. Levi and L. R. Levi, Golden Press, 1968

The Spider Book by John H. Comstock, Comstock Publishing Co. (Ithaca, New York), 1948

The World of Spiders by W. S. Bristowe, Taplinger, 1976

American Spiders by Willis J. Gertsch, Van Nostrand, 1949

Archaeoastronomy (p. 78)

Native American Astronomy by Anthony F. Aveni, University of Texas Press, 1975

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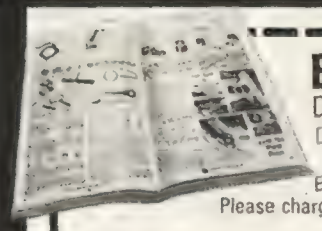

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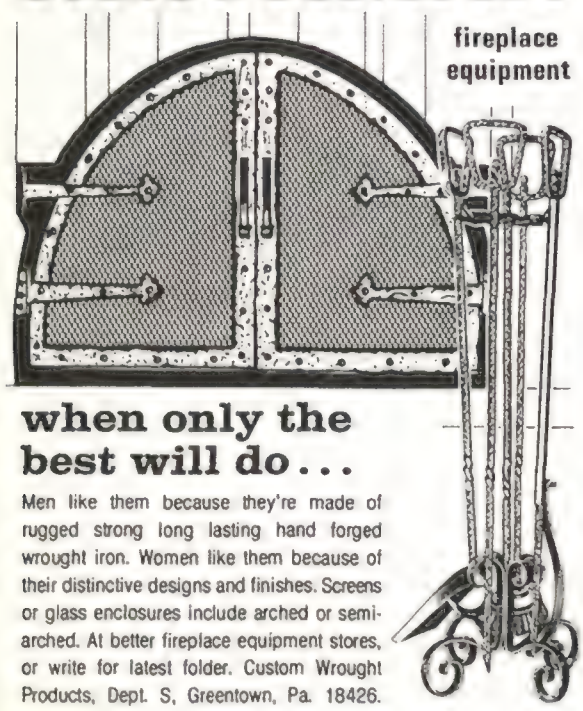

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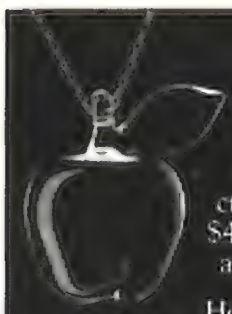

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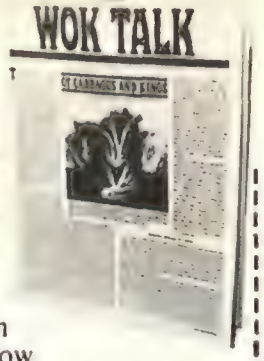

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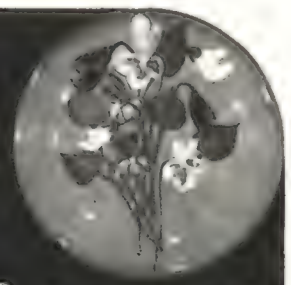

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Smithsonian highlights

October Events

The Smithsonian Institution's celebration of living folklore, the 12th annual Festival of American Folklife, opens October 4 and runs through the Columbus Day long weekend. Music, regional foods, demonstrations by skilled workers and craftsmen, and a return of the children's center will entice visitors to take imaginary walks through new neighborhoods: Oregon, Massachusetts, Maryland, New Mexico, Ohio and Mexico (see Around the Mall, pp. 30-38).

Folklife traditions are to be relived in widespread locations throughout the Smithsonian buildings and on the Mall. The Ellis Island immigrants' bench at the Museum of History and Technology will be filled by storytellers waiting to share their experiences. Sharecroppers, railroad porters, organ builders and a wheelwright are going to be stationed in the Museum of History and Technology to chat and show off their skills.

At the Renwick Gallery, in conjunction with a display of Mexican masks, craftsmen will show how they make masks. A native American is to fashion musical instruments against the background of an exhibit showing modern instruments. Films about featured communities will be shown at the Renwick and at the American Film Institute in the Kennedy Center.

The central arena for festival activities is once again out-of-doors on the Mall, with two main areas—one near the Museum of Natural History and the other close to the Washington Monument at 14th Street and Constitution Avenue. Mexicans and Mexican-Americans will

make music and demonstrate crafts near the Monument (see pp. 105-111 for a story about Mexican-American street murals). The children's area, generously flavored with the Latin tradition, promises to delight youngsters with games and music. The sounds of Cajun music of Texas oil workers will entertain visitors to the Coal-Mining and Oil-Producing Communities center.

Outdoor activities near the Museum of Natural History are to include New Mexico's San Juan Pueblo community members re-creating their life-style in food, dance and demonstration. In addition, the Chesapeake Bay fishing communities are to be well represented by sailmakers, netmakers, fishermen and seafood (inside and outside the museum). This might be a good place for you to end the weekend festivities with the oyster shucking contest on October 8.

Saul Steinberg Retrospective

Saul Steinberg's drawings have graced *The New Yorker* for years, as well as the walls of many galleries. This exhibition, which was organized by the Whitney Museum

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The exhibit opens on October 14 at the National Collection of Fine Arts and continues through January 1. Included among approximately 350 landscapes, religious paintings, decorative arts and murals by Vedder (1836-1923) are his drawings for illustrations in the 1884 edition of the *Rubáiyát of Omar Khayyám.*

Alan Sonfist / Trees

Opening on October 27 at the National Collection of Fine Arts, the exhibition runs through January 7. Sonfist combines natural materials (seeds, twigs, leaves) with photographs to examine the tree as a source of art, revelation and fantasy. His fascination with trees began during his childhood in the South Bronx, where he lived near one of the last forests in New York City. He took refuge from the streets in the serenity of the trees and began to draw them.

Ornament in the Twentieth Century

The Smithsonian's design museum in New York, the Cooper-Hewitt, opens a diversified exhibition of loan and collection objects to illustrate the importance of ornamentation in 20th-century design. The show runs from October 3 through January 7, 1979.

Artists' Postcards, Series II

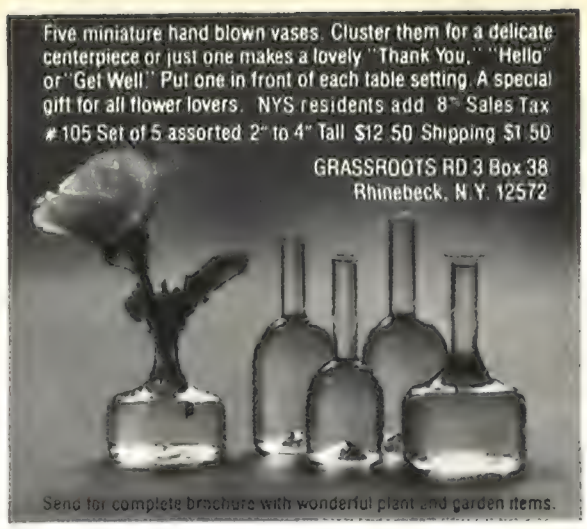
An exhibition of original works of art in postcard size starts at the Cooper-Hewitt on October 10 and runs through December 2. Series II contains 51 works of art in many techniques and media, including drawing and collage, created for a nonprofit publishing venture in 1977.

Continuing Events

Division of Performing Arts

• Jo Jones & Friends turned around mid-Thirties' concept of jazz drumming. They perform at Baird Auditorium, Museum of Natural History, on October 8 at 8 P.M.

• The 20th-Century Consort presents an evening of contemporary chamber music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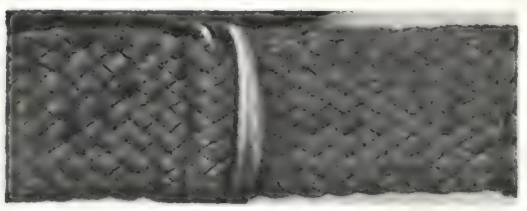

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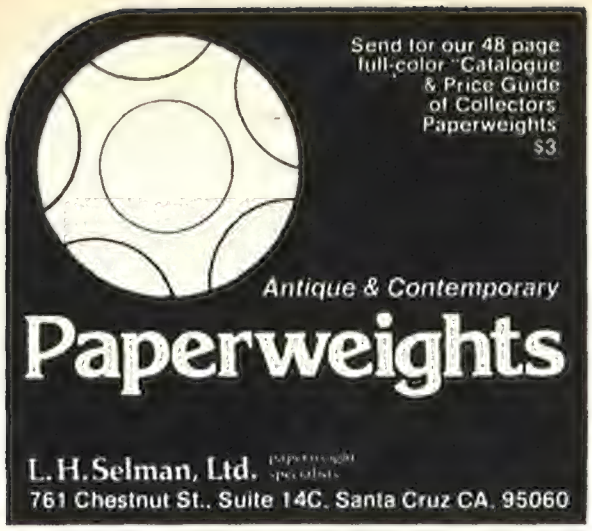
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in the Hirshhorn Auditorium on October 15 at 7 P.M.

- A free workshop will be given by the group above at Baird Auditorium on October 18 from 3 P.M. to 5 P.M.
- The Duke's Men (Ellington alumni and friends) present an informal jazz concert in the Hirshhorn Auditorium on October 22 at 6 P.M.
- Cantilena Chamber Players perform at the Hirshhorn Auditorium on October 28 at 5:30 P.M.
- "Dylan Thomas Lived Here," part of the World Explorer series, examines Wales through its poets. Welsh actor Ray Handy paints a verbal picture of his native land at Baird Auditorium on October 29 at 8 P.M.
- The Theater Chamber Players will perform at Baird Auditorium on October 30 at 8:30 P.M.

Radio Smithsonian

- During the week of October 1 the programs are:

"An American's Britain" with Robin Winks, who explores some lesser-known sights of particular interest to Americans.
"New Clue to Early Man" with Dennis Stanford discussing how a 20th-century elephant may help scientists date the earliest North American inhabitants.

- Topics for the week of October 8:

"Energy: What Next?" with energy alternatives debated by Barry Commoner, Denis Hayes and Alvin Weinberg.

- Programs for the week of October 15:

"Kin and Communities" with the late Senator Hubert Humphrey reminiscing about life in small Midwestern towns.
"The Fantastic Funnies," a journey through the comic pages from *The Yellow Kid* to *Peanuts*.

- During the week of October 22 watch for local listings of:

"The Time of Our Lives," a story of behind-the-scenes creation of some of the best covers of *Time* magazine.
"Everyone Can Fly (Almost)," a verbal visit to the General Aviation Gallery at the National Air and Space Museum where visitors talk about testing their skills in the museum's flight simulators.

- During the week of October 29 broadcasts include:

"Western Civilization: Tracing the Roots," a journey through the ancient civilizations of Mesopotamia, Egypt, Greece and Rome.

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Facing the Light
Continuing at the National Portrait Gallery through February 4, 1979, a loan exhibition of 110 historic American daguerreotypes.

Ancient Oriental Ceramics
The Freer Gallery continues a large show of the museum's collection of vases, bowls, dishes and ornamental pieces.

Mexican Masks
This exhibit continues at the Renwick Gallery through February 19, 1979, in conjunction with the Smithsonian's annual Festival of American Folklife, which this year emphasizes the crafts and folklore of Mexico.

World War II Aviation Films
The National Air and Space Museum continues its popular screenings of air-war movies in the museum theater on Thursday evenings at 7:30 P.M.

During your Smithsonian visit

Members are invited to begin their visit by registering with the Associates receptionist in the Smithsonian Institution Building—the castle on the Mall. Here, between 10 A.M. and 4 P.M. daily, Associates may pick up special orientation materials to ensure a more enjoyable visit. Membership cards are replaced upon presentation of a SMITHSONIAN magazine label. Here, too, Associates may relax in the lounge.

To help members plan their sightseeing at the Smithsonian, information packets are available by postcard or telephone request: Associates Reception Center, Smithsonian Institution, Washington, D.C. 20560; (202) 381-6264. Please allow two weeks for reply.

The Court
The Associates restaurant, The Court, located in the Museum of Natural History, offers a wide selection with buffet-style service. Lunch is served Monday through Friday, 11 A.M.-3 P.M. On weekends, breakfast is served from 8:30 A.M. to 11 A.M. and brunch from 11 A.M. to 3 P.M. Cost for lunch and brunch is $3.95 for adults and $2.80 for children; for breakfast, $2.95 for adults and $1.80 for children. Prices do not include beverage and dessert. Enter for breakfast via the

Constitution Avenue entrance of the museum. Membership cards are required.

Museum hours
Now in effect, Winter hours of most museums are 10 A.M. to 5:30 P.M. daily. During October the National Zoo keeps its grounds open from 6 A.M. to 7:30 P.M. Zoo buildings are open 9 A.M. to 5:30 P.M. The Anacostia Neighborhood Museum is open 10 A.M. to 6 P.M. Monday through Friday and 1 P.M. to 6 P.M. on weekends.

Public Dining Facilities
- The Museum of History and Technology has cafeteria service for visitors from 11 A.M. until 2 P.M. daily and snack bar service from 10 A.M. until 5 P.M. daily.
- The Air and Space Museum has snack bar service from 11 A.M. until 5 P.M. daily.
- The Museum of Natural History also has snack bar service from 10 A.M. until 5 P.M. daily.
- On the Mall there are National Park Service kiosks that sell sandwiches and snacks. Private vendors sell similar food near the museums on Independence and Constitution Avenues.
- At the National Zoo the Mane Restaurant, the Pop Stop and the Panda Café operate food services on varying schedules.

Wheelchairs and Strollers
Wheelchairs are available free of charge in all Smithsonian museums. Visitors with young children should bring their own strollers, except to the Hirshhorn Museum, which does not permit strollers, but will provide backpacks for visitors.

Parking
A very limited amount of free parking is available on Madison and Jefferson Drives along the National Mall between 10 A.M. and midnight.

The National Air and Space Museum has an underground garage on 7th Street, S.W., just north of Independence Avenue. Hours are 7 A.M. to 6:30 P.M. Monday through Friday and 9:30 A.M. to 6:30 P.M. weekends and holidays. The charge for parking is 75 cents an hour for the first three hours and $1.10 an hour thereafter.

For the Camera Buffs
Hand-held cameras only are allowed in all of the Smithsonian museums. Flash attachments are permitted only in the National Air and Space Museum, the

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Exploring the World with the Smithsonian

For both the seasoned and would-be traveler, the Smithsonian has developed a travel program to meet a variety of tastes and budgets. In order to accommodate the increasing growth and interests of Smithsonian Associates, the tour programs have expanded, bringing travelers to places reflecting the Institution's interests.

Foreign Charter Tours

Japan—November 5-21: The heart of historic Japan with an extended program in Kyoto and Nara followed by choice of travel seminars to the Inland Sea or the Sea of Japan. Conclude in Tokyo with visits to Nikko or Kamakura. Visit ancient temples, castles and shrines. (Originates and ends in San Francisco.)

Winter Russia*—December 28-January 11: Includes the historic and diverse cities of Leningrad, Tallinn and Moscow plus optional two-day excursion to Vladimir and Suzdal; attend special festivities including gala New Year's Eve party and a traditional troika ride; life-seeing visits to schools, factories or clinics; attend the Russian theater and circus.

Mayan Mexico: The Yucatán Peninsula—January 4-16 or January 28-February 9: A complete tour of the extraordinary Mayan ruins of Yucatán. An adventure tour. (Originates and ends in Mérida.)

Guatemala—January 17-28 or February 14-25: With an archaeologist, visit Tikal, the monumental Mayan city of the Petén jungle; Copán; the ruins of Quiriguá, El Baúl, La Democracia. Adventure tour. (Originates and ends in Guatemala City.)

Kenya, East Africa*—February 1-18: Wildlife and tribal life adventure providing modern insight—and the "Africa that used to be," in the old safari tradition. Seminars in Nairobi and in the field—Masai Mara; Samburu; Kilaguni.

New Zealand and Fiji—February 21-March 11: Tour includes Mt. Cook, Te Anau and Milford Sound, plus Auckland, Rotorua, Wellington and Christchurch. Included will be talks on New Zealand's natural history, Maori heritage, parliament, a home visit. Rest stop at Fiji before return. (Originates and ends in Los Angeles.)

Springtime in Greece*—April 29-May 15: A program in Athens and a day cruise to Hydra and Aegina, followed by visits to the renowned sites of ancient civilizations when the countryside is a paradise of wild flowers. An inland tour to the Peloponnesos, Epirus, Thessaly, the Pelion peninsula and the country around Delphi highlights the mountains.

Paris and the French Countryside*—May 13-27: Museum lectures, a walking tour of the islands of the Seine and excursions to Chartres and Malmaison plus a choice of a week-long travel seminar to Burgundy, to Dijon, Beaune and other towns of this wine and food center; Provence, including Avignon, Aix-en-Provence and Marseilles; or Normandy and Brittany's towns and villages.

Russia*—May 20-June 3: Leningrad, Tallinn and Moscow; see the Hermitage and Tretyakov Museums, the palaces of Pushkin or Petrodvorets, the ancient Kremlin with its old churches and Armory Museum; life-seeing visits to schools, factories or clinics; theater and circus.

Scotland*—September 9-23: Edinburgh and beyond—a program of walking tours and special visits through the Highlands and Lowlands of Scotland.

Sultans' Treasures*—September 23-October 7: An adventure tour to Istanbul and Asiatic Turkey, an evening in a Turkish home and a cruise on the Bosphorus. Select an excursion to Aegean Turkey; or Anatolia and Cappadocia.

Spain*—September 30-October 14: Madrid with museum visits, Spanish folk life and crafts, and day excursions to Toledo or El Escorial. Week-long travel to the Basque country and Barcelona; Andalusia and Cordoba; or the Pilgrimage road to Santiago de Compostela.

Low cost of tours includes first-class hotels, most meals, sightseeing, lectures, theater tickets and air fare. *Optional predeparture course will be available.

Domestic Study Tours

Illinois Archaeology—October 14-21: Join archaeologists in the excavation of an Illinois River valley site spanning almost 10,000 years. Actual digging will be supplemented by instruction, lectures, laboratory work and field trips.

Christmas at the Smithsonian—December 8-10: Seventh annual Christmas weekend with traditional tree-trimming party and special behind-the-scenes tours.

Virgin Islands Adventure—January 5-14 or January 19-28: Explore the British Virgin Islands by chartered sailboat to learn about the life of the coral reef.

Yosemite in Winter—January 26-February 4: Absorb the splendor of Yosemite in winter, while learning about this unique park under the guidance of Yosemite Institute staff. The program will include cross-country skiing and evening lectures on subjects such as forest ecology, glaciology, astronomy and wildlife.

Baja Whale Watch—February 9-17 or February 17-25: Observe gray whales and marine life from San Diego to San Ignacio Lagoon, on a sport-fishing boat. Study natural history of Baja coast and islands.

South Texas Wildlife—February 24-March 4: Follow the winter bird migration to the warm climate of the Gulf and Rio Grand Valley to explore the fascinating wildlife refuges of Aransas, Padre Island, Laguna Atascosa and Santa Ana.

Washington "Anytime" Weekend: Choose any weekend to enjoy a special tour of the original Smithsonian building, spend two nights at Loew's L'Enfant Plaza Hotel close to the Mall, and see other sights in Washington by Tourmobile. Reservations and payments must be received at least ten days prior to arrival.

Foreign Study Tours

Red Sea Passage—February 1-11, 1979: Revised version of the very popular voyage of this past winter. Sail from Suez on the *Argonaut*, visit Karnak, Luxor, Valley of the Kings and Abu Simbel in Egypt, Petra in Jordan. Stay at the Mena House Hotel next to the Pyramids for Sakkara and Memphis, the mosques, bazaars and Archaeological Museum of Cairo. *Cruise subscribers may add one or both of the following two options:*

Jerusalem Prelude—January 25-February 2, 1979: Also visit Damascus, Baalbek, Basra and Jerash before boarding in Suez.

Tanzania Game Preserves Postlude—February 11-18, 1979: Fly from Cairo to Kilimanjaro, visit Arusha, Ngorongoro Crater, Serengeti and Lake Manyara. Return to the United States via London.

Himalayan Cultures—March 21-April 15, 1979: Delhi, Agra, Calcutta, Darjeeling, Nepal (including tigers and Everest viewing), and Bhutan for a five-day exploration.

The Lands of the Hapsburgs—May 14-June 5, 1979; View palaces, sites of countries once dominated by ruling family of the Austro-Hungarian Empire; Venice, Trieste, Salzburg, Linz, Budapest, Vienna, Bratislava and Prague.

Write Smithsonian Associates Travel Program, A&I 1278, Smithsonian Institution, Washington, D.C. 20560 or call (202) 381-5635.

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Smithsonian Institution Traveling Exhibition Service

SITES circulates exhibitions to hundreds of cities throughout the United States. To sponsor a show in your community write: Eileen Harakal, SITES, Smithsonian Institution, Washington, D.C. 20560. Here are some October openings:

- Scottsdale, Arizona — "The Human Form: Sculpture, Prints and Drawings by Fritz Wotruba," Scottsdale Center for the Arts, October 7-November 9.
- Pomona, California—"American Agriculture: A Continuing Revolution," California State Polytechnic University, October 14-November 12.
- Greeley, Colorado—"Folk Art and Crafts: The Deep South," Civic Center Complex, October 7-November 5.
- Grand Junction, Colorado—"Adam and Eve: Their Portrayal," Western Colorado Center for the Arts, October 7-November 5.
- Wilmington, Delaware — "Oliphant: Paintings and Cartoons," The Historical Society of Delaware, October 28-November 26.
- Gainesville, Florida—"Folk Art and Crafts: The Deep South," Santa Fe Community College, October 7-November 5.
- Gainesville, Florida—"Images of Earth from Space," University of Florida Grinter Gallery, October 21-November 19.
- Jacksonville, Florida—"A Cartoon History of United States Foreign Policy, 1776-1976," University of North Florida, October 7-November 5.
- Albany, Georgia—"Folk Art and Crafts: The Deep South," Thronateeska Heritage Foundation, October 7-November 5.
- Athens, Georgia—"George Grosz: Works in Oil," University of Georgia Museum of Art, October 28-December 10.
- Waycross, Georgia—"Extra! Extra! The Men and Machines of American Journalism," Okefenokee Heritage Center, October 7-November 5.
- Carterville, Illinois—"Portrait of America," John A. Logan College, October 7-November 5.
- Chicago, Illinois—"Buildings Reborn: New Uses, Old Places," a new architectural show, Museum of Contemporary Art, October 5-November 15.
- Shreveport, Louisiana—"A Cartoon History of United States Foreign Policy,

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CHINA: A CULTURAL HISTORY—January 21-26 (repeat of popular program)

THE ASTRONOMY OF THE ANCIENTS—March 25-30

FRENCH IMPRESSIONST PAINTING—April 1-6

HORTICULTURE: A PRACTICAL APPROACH TO 18th-20th CENTURY GARDENING—April 29-May 4 (repeat of popular program)

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Since the groups are small and demand will be heavy (China and Horticulture are repeated because they were originally oversubscribed), you are urged to write immediately for full information on program content, accommodation and registration fees by seminar title to:

Selected Studies, National Associate Program
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1776-1976," Meadows Museum, October 7-November 5.

- Frostburg, Maryland—"James Weldon Johnson," Frostburg State College Library, October 28-November 26.
- Westminster, Maryland—"Five Critical Elections," Western Maryland College, October 14-November 12.
- Boston, Massachusetts—"Subways, An Underground Exhibition," Washington St. Concourse, October 14-November 12.
- Milton, Massachusetts—"Carl Jung," Curry College Library, October 19-November 19.
- Wellesley, Massachusetts—"Suiting Everyone," Babson College Library, October 1-December 10.
- Brighton, Michigan—"What's In a Map?" at Brighton State College, October 7-November 5.
- Minneapolis, Minnesota—"The Art of Scientific Illustration," Bell Museum of Natural History, October 7-November 5.
- St. Joseph, Missouri—"The Tallgrass Prairie: An American Landscape," Central St. Joseph Museum, October 21-November 19.
- St. Louis, Missouri—"America's Architectural Heritage," Washington University School of Architecture, October 21-November 19.
- Manchester, New Hampshire—"Shaker Built," St. Anselms' College, October 28-November 26.
- Columbus, Ohio—"Antarctica," Ohio State University Institute of Polar Studies, October 21-November 19.
- Toledo, Ohio—"Artists' Postcards," Toledo Museum of Art, October 14-November 12.
- Oklahoma City, Oklahoma—"Man in His Environment," Oklahoma Science and Arts Foundation, October 14-November 26.
- Corvallis, Oregon—"Terminal, Station and Depot," Oregon State University, October 7-November 5.
- Odessa, Texas — "Photographing the Frontier," University of Texas of the Permian Basin, October 28-November 26.
- Lexington, Virginia — "Sculpture of Jacob Epstein," Washington and Lee University, October 28-November 26.
- Salem, Virginia—"An American Inspiration: Danish Modern and Shaker Design," Roanoke College, October 21-December 3.
- Toppenish, Washington—"Story of a Goblet," Toppenish Museum, October 14-November 12.

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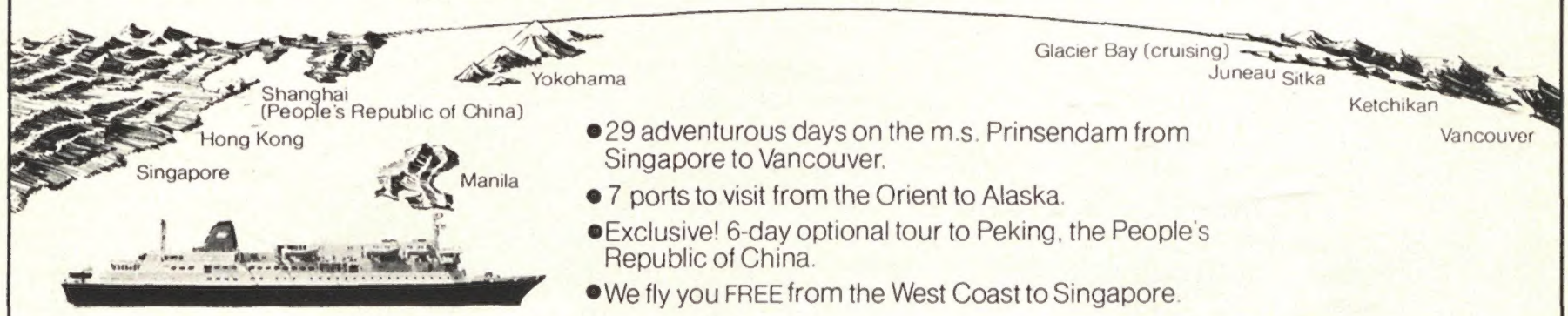

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By Patrick Ryan

Memory serves —a double fault

The hearts of many fellow amnesiacs will go out to the vicar in Cornwall, England, who confessed to a newspaper reporter that "I have always been able to remember faces but names elude my memory. When I came to this parish three months ago, I decided to make a serious effort to correct my natural weakness. I took more than 500 colored photographs of churchgoers and wrote the names underneath."

Sadly—life being like that—three days after he'd completed his memorial gallery, he was transferred to Northumberland.

When it comes to putting names to faces, experience suggests that human beings are manufactured in two brands—those who always remember, and those who invariably forget. Being myself among the latter, I am frequently embarrassed at social soirees when one of the former greets me fervently as an old friend and bosom acquaintance. While I find his jovial features vaguely familiar, I cannot summon up a single syllable of his name. Those of the absent mind will know how cold-sweating such a situation becomes when etiquette requires that you introduce this unknown him to your wife.

Red hot though the cogwheels of your memory may spin, you are eventually forced back once again on the familiar ploy of murmuring, "How nice to meet you again, and I'm sure that you remember my wife." Accustomed though she is to be thus left groping, it does play further hell with her elegant aplomb when, on especially panicky occasions, you also forget *her* Christian name.

Equal discomfiture has to be endured, of course, on those once-in-a-blue-moon moments when, having at long last recognized a face and also remembered its name, you advance triumphantly across a crowded room only to have the object of your recollection announce, bleak-eyed, that he can't remember you from Adam.

Comfort can be taken, however, that this obliterated plight is not so dire as that which befell the visitor to the Rev. William Spooner—the eponymous originator of Spoonerisms—who received the greeting, "I remember your name perfectly, but I just can't think of your face." Nor so chastening as the salutation of Groucho Marx when he advised his victim that "I never forget a face, but in your case I'll make an exception."

I have it on the authority of Dorothy Parker that women and elephants never forget. And, particularly, my field research into this aphorism has revealed that it goes in spades for married women, for they invariably possess unrelenting recall of even the most minuscule of their spouses' past iniquities. The retrospective inequality of the sexes is further exemplified by the majority of husbands who have difficulty in recalling their own natal dates, while their computerized wives can remind them of the calendar requirement to buy birthday presents for relatives whose remoteness challenges infinity.

The inadequate mental retention of wedlocked males is also evidenced by the deplorable frequency with which their spouses have to bawl them out for never really remembering things that they tell them. When Eve first blossomed into curvaceous shape from out of Adam's spare rib, probably the second thing she said to him was, "Why don't you ever remember anything I tell you? Why does it all just go in one ear and out the other?"

This feminine recollective superiority may trace its origins from Greek mythology in which Mnemosyne, a lady, was deified as the Goddess of Memory. She unprofessionally forgot, however, to protect her honor from the attentions of bed-hopping Zeus, and bore him nine daughters who became the Nine Muses.

Popular songwriters have ever been concerned with giving thanks for the memory, reporting that memories are made of this, and bringing autumnal tinges to their verses because September and November are among the few available rhymes to "remember." But, even when Bing Crosby melodiously assured me so, I have never been convinced of the lyrical accuracy of that sentimental song which contends in its chorus line that "It's easy to remember/But so hard to forget." Swinburne seemed to have described better the mundane aftermath of mad, passionate love when he apostrophized a lost lady with: "And the best and the worst of this is/That neither is most to blame/If you've forgotten my kisses/And I've forgotten your name."

That feat of unremembering was perhaps exceeded by Italo Svevo, who pronounced that "There are three things I always forget. Names, faces and—the third I can't remember." . . . And who, some may ask, is Italo Svevo? Would you believe it, but at this moment, I can see his face well, but can't quite remember!

Note: Of course Italo Svevo, 1861-1928, was a writer, noted mainly as a pioneer of the psychological novel in Italy. He employed James Joyce to teach him English in Trieste and they became fast friends.

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Virginia Wade

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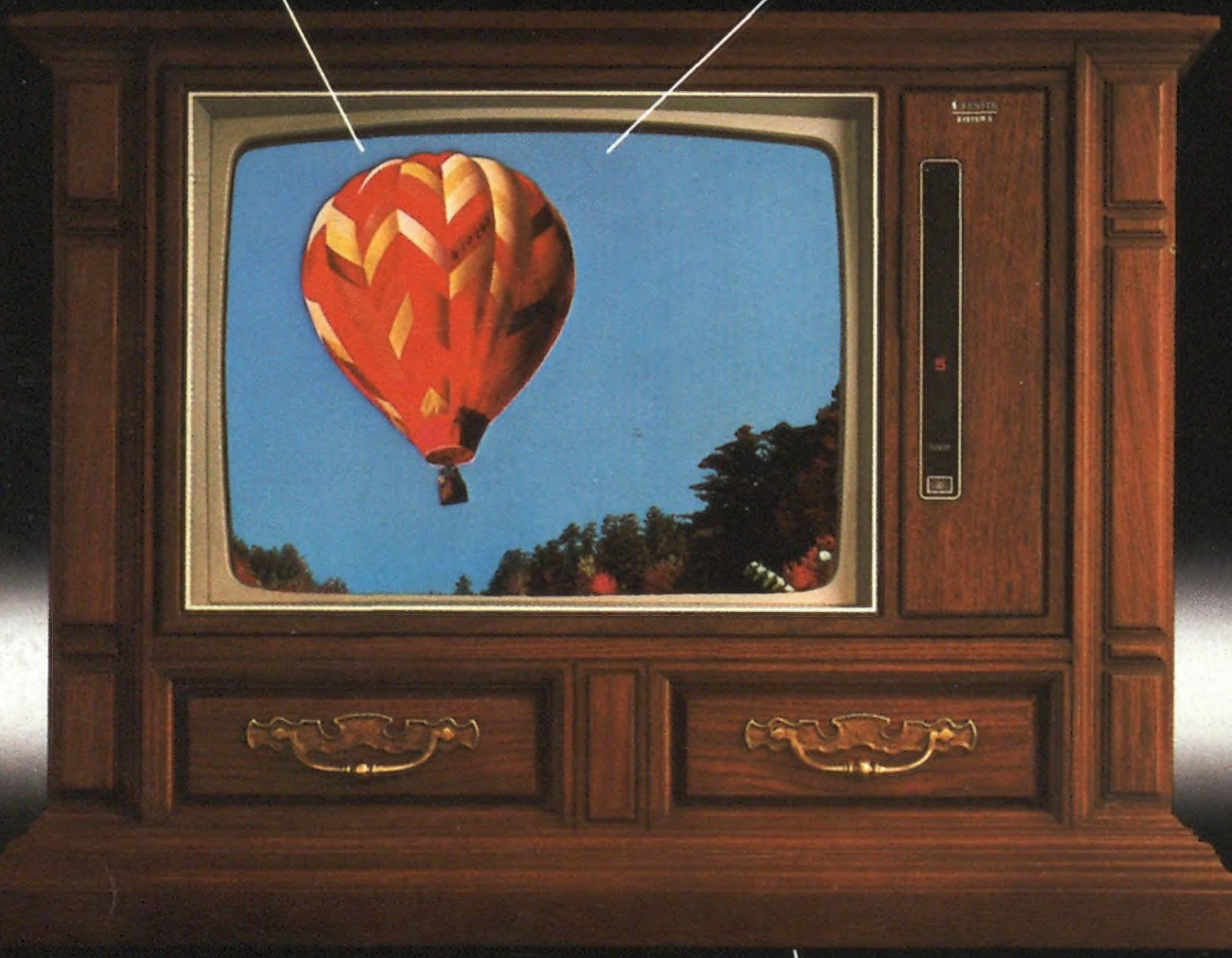

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